PAGE'S WEEKLY.—April 28, 1905. Thin Paper Copy for Circulation Abroad.

No. 33. Vol. 6. SIXPENCE. (Registered as a Newspaper.) FRIDAY, APRIL 28, 1905.

PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

France, Paris: 22, Rue de la Banque.
Germany, Berlin: 13, Unter den Linden.
Russia, St. Petersburg: 14, Nevsky Prospect.
Italy, Rome: 307 Corso.
Austria, Vienna: Kärntnerstrasse, nr. 30.

India, Calcutta: Thacker, Spink & Co.
" Bombay: Thacker & Co., Ltd.
South Africa, Cape Town: Gordon & Gotch.
Japan, Yokohama: Kelly & Walsh, Ltd.
New Zealand: Gordon & Gotch, Ltd.

Canada: Montreal News Company.
United States, New York: International News Co.
" Chicago: Subscription News Co.
Australia, Melbourne: Gordon & Gotch.
Straits Settlements, Singapore: Kelly & Walsh, Ltd.

PAGE'S WEEKLY — Miscellaneous

PAGE'S WEEKLY — Miscellaneous

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

Contracts

CONTRACTS.

COUNTY OF SALOP. — TO STEEL BRIDGE BUILDERS.

TENDERS are invited for the TAKING DOWN of the old CAST-IRON BRIDGE at Buildwas, and for the SUPPLY and ERECTION in its place of a STEEL CURVED GIRDER BRIDGE.

Copies of the drawings and specification may be obtained at my office on and after Wednesday, April 19th, on payment of Five Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, on the form supplied, endorsed "Steel Bridge," must be delivered at my office not later than 10 a.m. on Wednesday, May 3rd.

Power is reserved to reject the lowest or any Tender.

(Signed) A. T. DAVIS, M.Inst.C.E.,
County Surveyor.

Shirehall, Shrewsbury,
April 12th, 1905.

BOROUGH OF SALISBURY.

NEW SEWAGE AND ADDITIONAL SEWAGE DISPOSAL WORKS.

NOTICE TO CONTRACTORS.

THE CORPORATION OF SALISBURY are prepared to receive TENDERS for:—

CONTRACT No. 1.

For the LAYING of about 7,700 lineal yards of CAST-IRON PIPE SEWERS, varying from 2½ in. to 24 in. in diameter; of about 7,900 lineal yards of STONEWARE PIPE SEWERS, varying from 7 in. to 12 in. in diameter; and the CONSTRUCTION of 180 lineal yards of EGG-SHAPED SEWERS, together with the necessary Manholes, Flushing Chambers, Ventilating Columns, &c., and various alterations to and connections with the existing Sewers and House connections; and such alterations as may be necessary to the existing Water, Gas, and other Mains and connections; and the Construction of two EJECTOR CHAMBERS, with complete equipment of Shone's Automatic Pneumatic Ejectors, all situated in the Borough of Salisbury.

CONTRACT No. 2.

For the CONSTRUCTION of a SCREENING CHAMBER, various alterations to the Walls of the existing Tanks; the Sinking of a Cast-iron Cylinder through the invert of the existing tanks, and formation of a Sump; the provision of additional Sludge Suction Pipes; the formation of a Storm-water Basin, with separating Weirs, Channel and Storm-water Filter, about ¾ acre in area; the Construction of five Continuous Filters, provided with Sprinklers, containing about 1,000 cubic yards of Clinker each, with various Channels; and the Construction of 4 acres of Secondary Filter Beds.

Instructions for Tender and Form of Tender, with the Form of Contract and Schedules annexed, can be obtained, and the Drawings inspected on application at the Office of Sir A. BINNIE & SONS, 9, Great George Street, Westminster, or by appointment with Mr. W. H. WHITE, at 45, High Street, Salisbury, on payment of £1, which will, after the Corporation or their Committee have come to a decision upon the Tenders received, but not before, be returned to the Tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same.

The Tender and accompanying documents must be enclosed in a sealed cover, addressed to the Town Clerk, and endorsed in the left-hand corner "Tender for New Sewers," or "Tender for Additional Sewage Disposal Works," and be delivered at the Municipal Offices, Salisbury, not later than the 1st May, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
FRANCIS HODDING
Town Clerk.

Municipal Offices, Salisbury,
April 12th, 1905.

EAST INDIAN RAILWAY. — The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of:—

(1) STEEL MATERIAL (Joists, Channels, Bulb-tees, etc.).
(2) MISCELLANEOUS TOOLS,

as per specifications to be seen at the Company's Offices.

Tenders are to be sent to the undersigned, marked "Tender for Steel Material," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 3rd day of May proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of One Guinea is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
April 13th, 1905.

EDINBURGH CORPORATION ELECTRICITY SUPPLY.

The Lord Provost, Magistrates, and Council invite TENDERS for the following WORK, in connection with their Electricity Supply Station at M'Donald Road:—

Specification No. 16.—WATER-TUBE BOILERS.

Copies of the specification, form of Tender, general conditions, and drawings can be obtained from the Engineer, Dewar Place, Edinburgh, after Wednesday, April 19th, upon payment of a deposit of £2 2s., which will be refunded on receipt of a *bonâ fide* Tender, and on the return of the specification, general conditions, and drawings.

The specification, general conditions, and drawings can be seen at but not obtained from, the office of Dr. A. B. W. KENNEDY 17, Victoria Street, London, S.W.

Tenders, on the prescribed Form, enclosed in sealed envelope, and endorsed on the outside "Electricity Supply.—Tender for Specification No. 16," must be delivered at the office of the undersigned not later than Monday, May 8th, 1905.

THOMAS HUNTER, Esq.,
Town Clerk.

City Chambers, Edinburgh,
April 7th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

CONTRACTS.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the COUNCIL invite TENDERS for the CARRYING OUT of the FOLLOWING WORKS at their Sewage Pumping Station—viz.:—

CONTRACT No. 1.—For Supplying and Fixing Two Lancashire Boilers, 18 feet long by 6 feet 6 inches diameter.

CONTRACT No. 2.—For Supplying and Fixing Steam Pumping Engine and Pumps.

In connection with this Contract, persons tendering are required to submit detailed Drawings and Specifications of the type of Engine and Pumps they propose to supply.

CONTRACT No. 2A.—For Supplying and Fixing Gas Pumping Engine and Pumps, together with Suction Gas Plant complete.

Printed Specifications and Forms of Tender will be forwarded on application to the undersigned. Applications to be accompanied by a deposit of £2 2s. in each case, which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders, endorsed "Contract No. —" to be sent to me by 4 o'clock p.m. on Monday, the 8th day of May, 1905.

The Council do not bind themselves to accept any Tender

By order,
THOS. SWATHERIDGE,
Clerk of the Council.

Council Offices, 7, North Street, Bishop's Stortford,
March 17th, 1905.

BOROUGH OF BARROW-IN-FURNESS.

TO CONTRACTORS.

THE CORPORATION OF BARROW-IN-FURNESS invite TENDERS for the CONSTRUCTION of a STEEL ROAD BRIDGE over the Walney Channel, uniting Barrow Island and Walney Island.

The Bridge will be about 1,123 ft. in total length between abutments and 50 ft. in width, and will consist of eight fixed girder spans, and one opening span, on cylinder foundations.

Drawings may be seen, and Specifications obtained, at the Office of the Engineer, Sir BENJAMIN BAKER, K.C.B., at 2, Queen Square Place, Queen Anne's Mansions, Westminster, on and after Monday, April 17th, 1905.

Sealed Tenders, endorsed "Tender for Bridge over Walney Channel," must be addressed to the Town Clerk of Barrow-in-Furness, and delivered at his Office, Town Hall, Barrow-in-Furness, before Noon on Monday, May 15th, 1905.

The Corporation does not bind itself to accept the lowest or any Tender.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness,
April 8th, 1905.

TENDERS will be received by the Montreal Water and Power Company up to May 15th next on a Fifteen Million Gallon High-duty STEAM PUMPING PLANT, BOILERS, etc., 175lb. water pressure. Specifications can be had on application to the Offices of the above Company, 62, Alliance Building, 107, St. James Street, Montreal, Canada.

PAGE'S WEEKLY Contracts

MANCHESTER CORPORATION GAS-WORKS.

TO OIL IMPORTERS AND OTHERS.

The GAS COMMITTEE of the Corporation of Manchester are prepared to receive TENDERS for the SUPPLY of OIL for the manufacture of Carburetted Water Gas. The oil to have a flashing point of not less than 73 degrees (Abel's test), and not less than any higher degree of temperature which may be specified in any future Act of Parliament or regulations to be made thereunder.

Full description, with the analysis of the oil offered, must be submitted with each Tender, as well as a sealed sample of the same. The quantity of oil to be delivered free of all charges (including Ship Canal dues) into the storage tanks of the Corporation at Trafford Wharf, on the banks of the Manchester Ship Canal, in such quantities as may be from time to time required by the Gas Committee, will be 10,000 to 15,000 tons during the Twelve Months ending September 30th, 1906. Tenders to be at a price per imperial gallon.

Further particulars may be obtained on application (in writing only), to Mr. CHARLES NICKSON, Superintendent of the Gas Department.

Sealed Tenders and samples, addresssed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Oil," must be delivered at the Office of the Superintendent of the Gas Department, Town Hall, Manchester, on or before Wednesday, May 10th, 1905.

The Corporation do not bind themselves to accept the lowest or any tender.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.
Town Hall, Manchester,
April 7th, 1905.

BRISTOL DOCKS.—THREE ELECTRIC LIFTS.

The Docks Committee of the City and County of Bristol are prepared to receive TENDERS for the CONSTRUCTION, DELIVERY, ERECTING in place, FITTING, TESTING, and MAINTENANCE for twelve months after completion, of TWO ELECTRIC GOODS LIFTS and ONE ELECTRIC PASSENGER LIFT, to be erected in the Tobacco Warehouse now in course of construction near Cumberland Basin, Bristol.

On and after Tuesday, April 11th, 1905, copies of the Specification, form of Tender, form of Contract, and Copies of Contract Drawing can be obtained from the undersigned on production of a receipt from the Secretary of the Docks Committee showing that £3 has been paid as deposit. The deposit of £3 will be returned to *bona fide* tenderers hereafter.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Electric Lifts," and addressed to the Secretary of the Docks Committee, 19, Queen Square, Bristol, and must be delivered to him, accompanied by the prescribed documents, before 10 a.m. on Monday, May 1st, 1905.

The Docks Committee of the Council of the City and County of Bristol do not bind themselves to accept the lowest or any Tender.

W. W. SQUIRE,
Engineer.
Engineer's Office, Cumberland Basin, Bristol,
April 5th, 1905.

REFUSE DESTRUCTOR AND FLAG-MAKING PLANT.

MUNICIPAL COUNCIL OF THE CITY OF SYDNEY, NEW SOUTH WALES.

The Municipal Council of the City of Sydney, New South Wales, invite TENDERS for the SUPPLY and ERECTION of SIX-CELL REFUSE DESTRUCTOR and for a FLAG-MAKING PLANT at Moore Park, within the City of Sydney, New South Wales.

Conditions of Contract, Specifications, and Tender Forms may be obtained on application to the Acting Agent-General for the State of New South Wales, Victoria Street, Westminster, S.W.

Tenders will be received up to Tuesday, May 30th, 1905, addressed to the Town Clerk, Town Hall, Sydney, New South Wales, endorsed "Tenders for Destructor and Flag Plant."

THOMAS H. NESBITT,
Town Clerk.
Town Clerk's Room, Town Hall, Sydney,
February 9th, 1905.

THE DUBLIN PORT AND DOCKS

Board is prepared to receive TENDERS for an ELECTRIC GENERATING STATION.

The specification and drawings, together with a special form of Tender, can be obtained at the office of the Engineer of the Board, JOHN P. GRIFFITH, Esq., M.Inst.C.E., East Wall, Dublin, on payment of Five Pounds, which will be refunded to firms sending in *bona fide* Tenders.

Tenders, with contractor's supplemental specification and drawings, marked on the outside of the cover "Tender for Electric Generating Station," must be delivered by post, sealed prepaid, and addressed to the Secretary, Port and Docks Office, Westmoreland Street, Dublin, on or before Monday, the 15th day of May, 1905.

The Board does not bind itself to accept the lowest or any tender.

By order,
N. PROUD,
Secretary.
Dublin Port and Docks Office,
April 3rd, 1905.

NOTICE TO MANUFACTURERS OF COPPER PLATES.

THE DIRECTOR-GENERAL, ORDNANCE SURVEY,

is prepared to receive APPLICATIONS from any FIRM which is willing to TENDER for the SUPPLY of COPPER PLATES for Photo Etching.

Applications for forms of Tender and Specification should be made to the Officer in Charge of Stores, Ordnance Survey Office, Southampton.

All Tenders must be submitted before noon on the 3rd May, 1905.

COUNTY OF LONDON.

TO MAKERS OF STORAGE BATTERIES AND OTHERS.

THE LONDON COUNTY COUNCIL

invites TENDERS for the SUPPLY, ERECTION at its GENERATING STATION, East Greenwich, S.E., and MAINTENANCE, for a period of ten years of a BATTERY of 280 ACCUMULATOR CELLS having capacities of 645 ampere-hours at a three-hour discharge rate, and of 450 ampere-hours at a one-hour discharge rate.

Persons desiring to submit Tenders may obtain the Specifications, Drawings, Bills of Quantities, Form of Tender, and other particulars at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £2. This amount will, after the Council or its Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender, and not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted. Full particulars of the work may be obtained on application at the County Hall, previously to the payment of the fee for the Specification, etc. Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with. The contractors will be bound by the contract to pay all workmen (except a reasonable number of legally bound apprentices) employed by them, wages at rates not less, and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule. Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Accumulators." No Tender will be received after 10 a.m. on Tuesday, the 16th day of May, 1905. Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.
County Hall, Spring Gardens, S.W.,
April 19th, 1905.

APPOINTMENTS OPEN.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR

India in Council will, in the Summer of 1905, make not less than TWENTY-FIVE APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday 1st May next.

A. GODLEY,
Under Secretary of State.
India Office,
March 23rd, 1905.

HULL MUNICIPAL TECHNICAL SCHOOL.

LECTURER ON ELECTRICAL ENGINEERING.

A LECTURER ON ELECTRICAL ENGINEERING

is required at the above School. The salary will commence at £160 per annum.

Further information and Forms of Application may be obtained from the undersigned, to whom applications should be sent not later than Thursday, May 4th.

J. T. RILEY, D.Sc.,
Director of Studies.
Education Offices, Albion Street, Hull,
April 11th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Perriam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.
World's Work and Play.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Milligarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

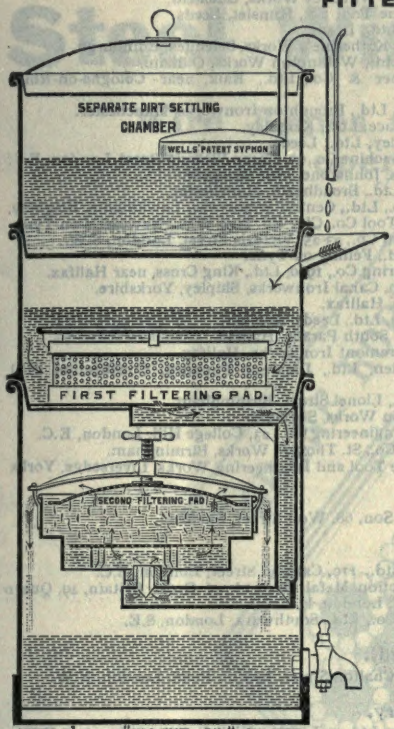
Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY

Wells' Specialities

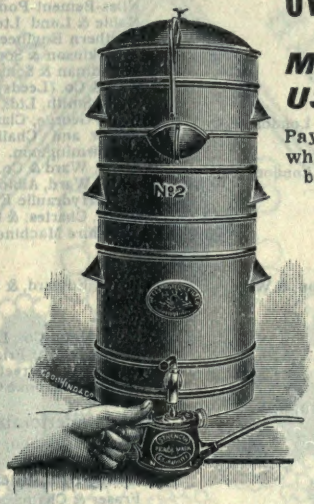
WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.



OVER *10,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in. 35/-
No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. .. 50/-
No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ... 70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ... 110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ... 189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in. 336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6.	Handy Size. No Tank. On Wheels.	£7 7s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose,	£9 10s.
	Same capacity as No. 4 Machine.	
No. 5.	With 5-ft. Pole, Double spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

Price 13/8 per cwt.,

Carriage Paid in England and Wales. (If in lots of 3 cwt. at a time, 12/8 per cwt.)

WELLS' "LIGHTNING"

Wallwork & Wells' Patents.

Lime & Color Washer.

No. 4a, with Wheels.

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

Works: Cheetham, Manchester. **LONDON, N.W.**

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds, England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Highroad Well Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

Buyers' Directory—(*Continued*).

Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.
Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.
Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.
Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.
Wm. Firth, Ltd., Leeds.

Railway Wagons.
Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).
Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.
Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).
Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.
British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.
Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.
Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.
Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.
S. Pegg & Son, Alexander Street, Leicester.

Superheaters.
A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.
Howard Bros., 10, St. George's Crescent, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.
Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.
G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.
Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.
Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd. Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Wian, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.
Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.
Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.
Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.
W. & T. Avery, Ltd., Soho Foundry, Birmingham, England
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.
A. C. Wells & Co., 100A, Midland Road, St. Pancras, London N W

Wind and Water Supply Machinery.
Eric S. A. Smith, Bridlington.

Wire Working Machinery.
Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."
"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY **Machine Tools**

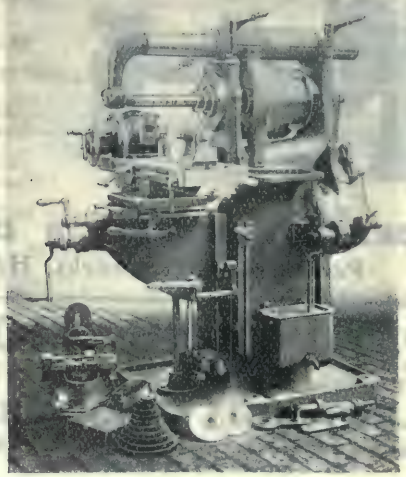
3 *Styles of Drive* | | | *Belting* *Belting* *Gearing* *and Gearing*

3'6" to 6'0" RADIALS

HIGHEST RATE OF FEEDS . .

Largest English Makers.

Northern Engineering (1900) Co., Ltd., HALIFAX.

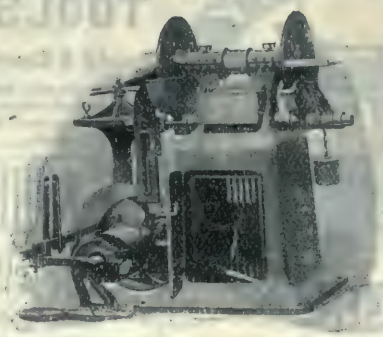


No. 2 Gear Feed Universal Miller.

J. Parkinson & Son, SHIPLEY, ENGLAND.

CUNLIFFE & CROOM, LTD.,

Broughton Lane, MANCHESTER

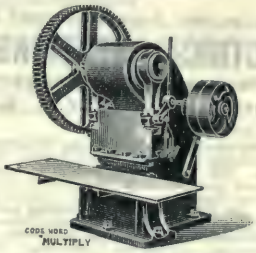


DISC GRINDER,

For Grinding and Finishing all Kinds of Metal.

ASK FOR DESCRIPTIVE LIST.

BERTRAMS LIMITED



Multiple Punching Machine.

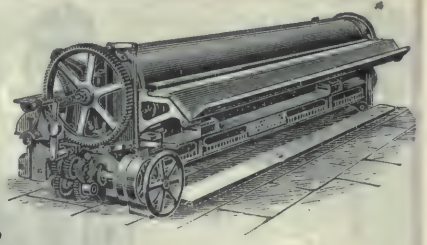
St. Katherine's Works, Sciennes, EDINBURGH.

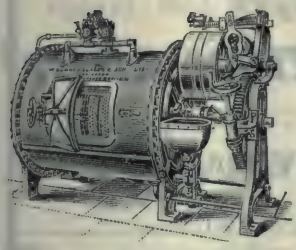
London Office: MOORGATE STATION CHAMBERS, E.C.

MACHINE TOOLS For Engineers, Shipbuilders, Boiler Makers, etc., etc.

PAGE'S WEEKLY — Machine Tools

Laundry Machinery AND COOKING APPARATUS.





W. Summerscales & Sons, Ltd.

CATALOGUE ON APPLICATION.

Phœnix Foundry, KEIGHLEY, ENGLAND.

Dean, Smith, & Grace, LTD.,

Lathe Manufacturers,

Established 1865. **KEIGHLEY.**

WRITE FOR CATALOGUE.

See Our Advertisement next Week.

HIGH-CLASS LATHES AND RADIAL DRILLS

Write for our Lists.

D. MITCHELL & CO. Ltd.,

Parsonage Works, KEIGHLEY.

Telegrams: "TOOLS, KEIGHLEY."

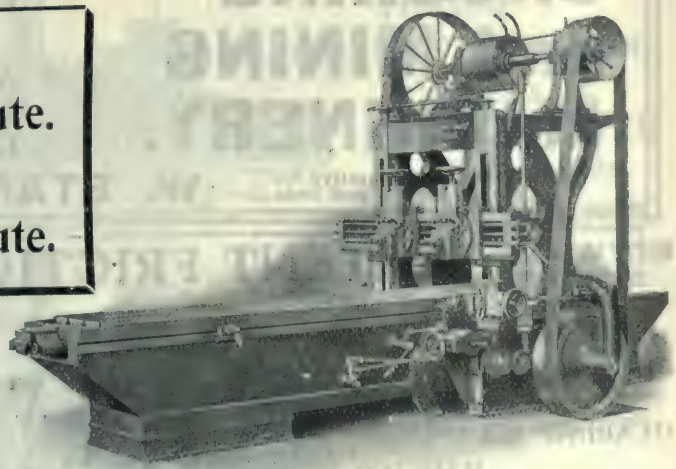
On War Office and India Office Lists

HIGH-SPEED PLANERS.

CUTTING AT **60** ft. per minute.

RETURNING AT **160** ft. per minute.

Note these Speeds, and compare them with those of your own Planers.



36 in. by 36 in. by 10 ft. Bateman High-speed Planer.

Bateman's Machine Tool Co., Ltd., Leeds.

PAGE'S WEEKLY

Machine Tools

PAGE'S WEEKLY — Machine Tools, &c.

ALL OUR LATHES

ARE FITTED WITH

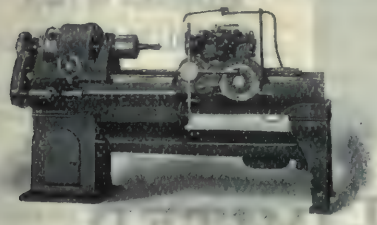
Patent Bed, Patent Loose Head,
Patent Screw-Cutting and Feed Motions.

INVESTIGATE THESE POINTS BEFORE BUYING.

JOHN LANG & SONS,
Johnstone, near GLASGOW.

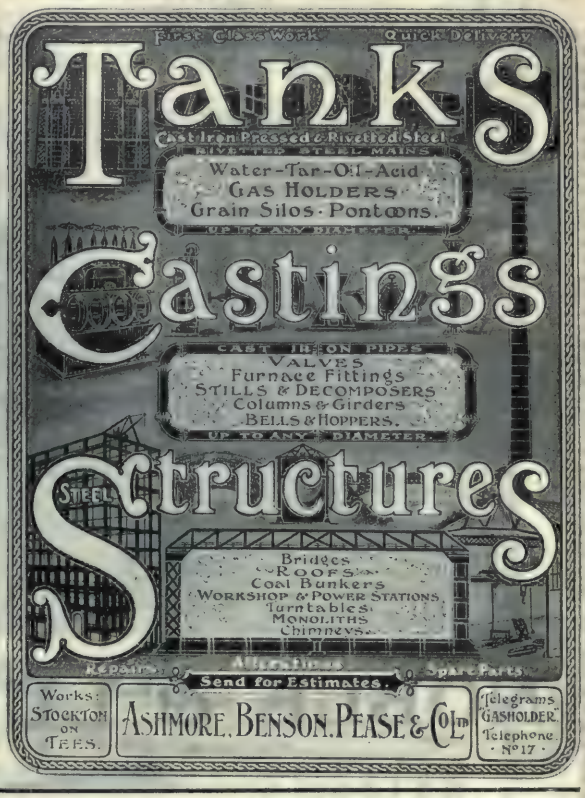
TURRET LATHES.

BRITISH MAKE THROUGHOUT.



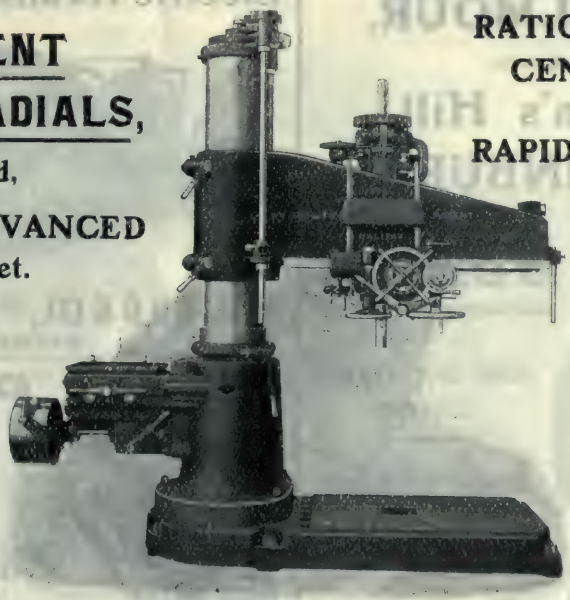
See our page Advertisement next week.

THE ECLIPSE TOOL MANUFACTURING CO.,
LINWOOD, near GLASGOW.



HIGH-SPEED DRILLING.

OUR PATENT
NEW TYPE RADIALS,
as illustrated,
are the **MOST ADVANCED** on the Market.



Will give a larger output at less consumption of power and with fewer breakages of Twist Drills.

RATIONAL DESIGN,
CENTRAL SPINDLE THRUST,
RAPID MANIPULATION,
CONSTANT POWER
at all Speeds.
LARGE RANGE
of Speeds
and Feeds.

Many other points of solid excellence which make these Tools a sound investment.

Send for Lists.

WILLIAM ASQUITH, Ltd.,
Well Road Works,
HALIFAX, England.

THE SPECIALISTS
in Machine Tools, for Drilling, Boring, Tapping, and Studding.

PAGE'S WEEKLY Machine Tools, &c.

PAGE'S WEEKLY — Packings

ON LAND AND SEA

"THE LANCASTER" (R.T.M.)

Metallic Packings

GIVE SURE SATISFACTION.

These Packings are used by the principal Navies and Steamship Lines of the world, and also by the largest engineers in this country and abroad.

"The Lancaster" Metallic Packings are simple—durable—reliable. They give **efficient packing** with a **minimum of friction.** They are made to stand all pressures and any degree of superheat. Write for Catalogue C, post free. **FIRST ORDERS SENT ON APPROVAL.**

LANCASTER & TONGE, Ltd.,

Makers of "The Lancaster" Pistons, Steam Traps, Steam Dryers, Grease Separators, combined with Feed Water Heaters. Feed-water Guaranteed 200 F. No tubes or other complications.

Engineers, Pendleton, MANCHESTER.

Manufacturers, Engineers, and Power Plants of every description

ALL OVER THE WORLD

are using

DANIEL'S P.P.P. ROD PACKING

Saving Thousands of Horsepower—

Converting Wasted Energy into Marketable Products. If you have not used it yet, DO SO at our expense. You'll be glad about it afterwards.

QUAKER CITY RUBBER CO.

RONALD TRIST & CO.

General Managers

Coronation House, Lloyd's Avenue, LONDON, E.C.

Late of (101, Leadenhall Street, E.C)

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY — Miscellaneous

Index to Advertisers—(Contd.)

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

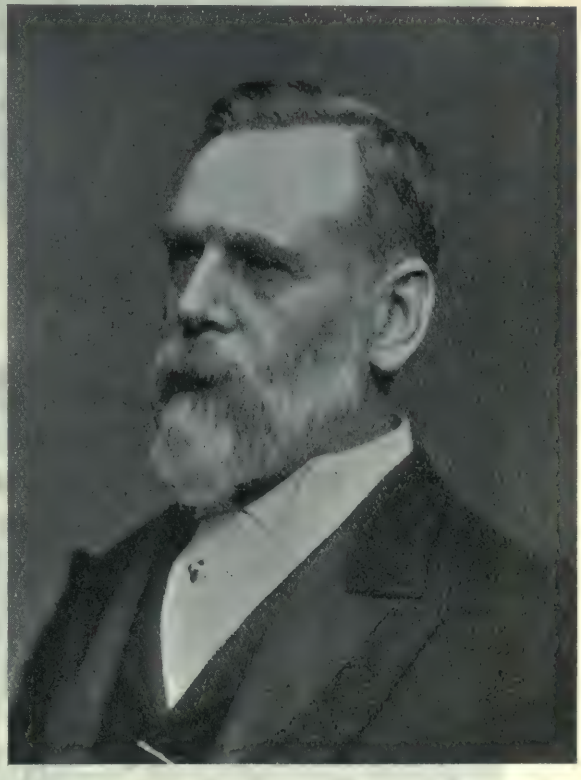
An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, APRIL 28, 1905. No. 33.

The Offices of "Page's Weekly," Wednesday Evening.

SIR ALEXANDER BINNIE, the newly-elected President of the Institution of Civil Engineers has, during recent years, been perhaps best known as the chief engineer of the London County Council, but his reputation stands on a wider basis than this. The new President was a pupil of Mr. J. H. La Trobe Bateman, himself a past-president of the Institution. Sir Alexander spent some years in the service of the Public Works Department of India, and on resigning that appointment in 1875 was for many years engineer to the Bradford Corporation, during which period he was responsible for many important projects, including an extension of the waterworks in the Nidd Valley. He was also associated with the construction of the Blackwall Tunnel. Sir Alexander is one of the leading authorities on questions connected with water supply.

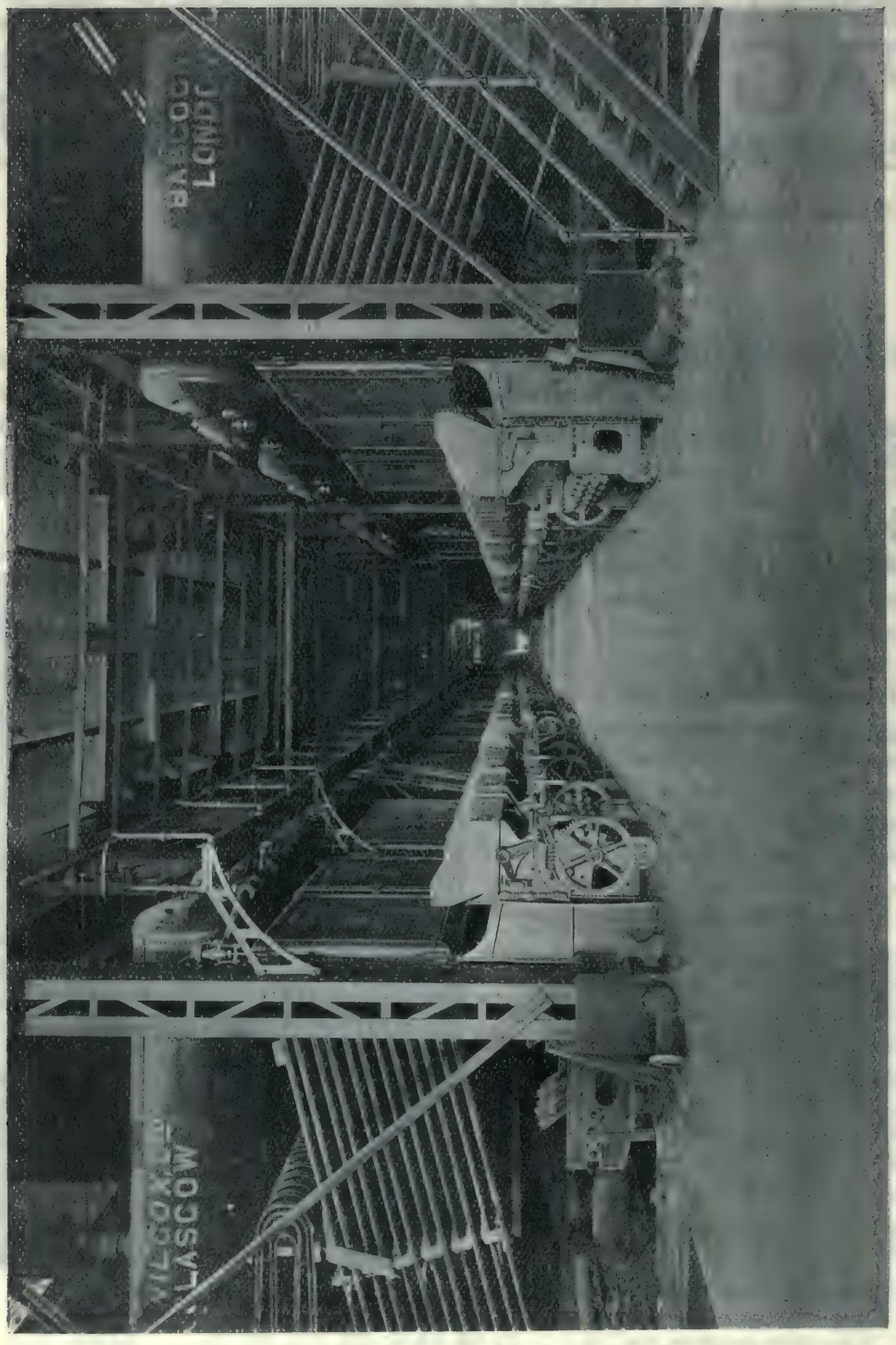
On another page we draw attention to a remarkable proposal by the Government of New South Wales, who are seeking tenders for the whole of the pig iron and rolled iron and steel which will be required for the service of the State during the next seven years. A significant clause states that not less than 90 per cent. of the pig iron used is to be produced from ore raised in the Commonwealth of Australia. Full details are given of the coal and iron deposits available, and it would appear that by this single coup the New South Wales Government is seeking to create a full-grown native coal and iron industry. The proposal is open until September 1st next.



Photo, Elliott and Fry.

SIR ALEXANDER BINNIE,

Who has just been elected President of the Institution of Civil Engineers.



UNDERGROUND ELECTRIC RAILWAYS COMPANY, OF LONDON, LTD., ELECTRICITY WORKS, LOT'S ROAD, CHELSEA.

Sixty-four Babcock and Wilcox Boilers, each of 5,212 square feet heating surface, fitted with superheaters and chain grate stokers, in course of erection.

Gold miners who are seeking new centres of activity, will read with interest the remarks on the mining prospects of Madagascar which Mr. James J. Lloyd, contributes to the current number of The South African Mines, Commerce and Industries. "It is difficult," says Mr. Lloyd, "to give figures as to the possibilities of Madagascar. The present production is about a quarter of a million pounds sterling a year. This is practially all alluvial, and produced by the most primitive methods known to man. The Compagnie Lyonnaise is the largest producer of gold, and is working at twenty different places. I have seen 30 lb. weight of gold come into their office at a time. A digger I know, a Mr. Hanning, was getting 5 kilos of gold a month when last I heard from him, which returned a profit of 1,000 francs a kilo, or £200 a month, and Hanning not only expected this to continue but to increase. I know places where quartz, returning large profits is being dollied by hand, such places are, however, very fluky, and rarely contain any quantity of ore. The "Talbot reef," which I believe is the richest yet struck, is not far from Tananarivo. This, I believe, has been secured by a French company. Alluvial has been worked for many years, but reef prospecting has only just begun. I am of opinion that no banket will ever be found in Madagascar, or that any one place will support a mining community even approaching the Rand in size or importance. Still I firmly believe that Madagascar will in time take an important position amongst the gold producing countries of the world. Anything like a rush to Madagascar at the present time could only end in disaster to all concerned. It is essentially a country where a man must depend entirely upon his own resources; no employment of any kind is to be had. I have no hesitation, however, in saying that a good capable prospector, especially if he has had experience in quartz reefs and alluvial, who has about £500 or more at his command, has the opportunity of making himself in Madagascar, but the ordinary man—no matter what his capabilities—with from fifty to a couple of hundred pounds capital, had better stay away. There is fever in parts of the island, but the country is not nearly so unhealthy as is generally supposed."

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Our readers may find it worth remembering that at the offices of PAGE'S WEEKLY, a file can be consulted of the Australian Official Journal of Patents. This publication, of which the earlier numbers have already reached us from Mr. George Townsend, Commissioner of Patents, is designed to furnish in convenient form and at the earliest opportunity, a record of the proceedings of the Patent Office, containing the most necessary information as to the nature of new specifications recorded by inventors, "always having careful regard for the statutory rights, both of patentees who possess the monopoly, and of the public who are to have the free use of such knowledge at the expiration of the monopoly." The publication will replace and amplify the notices hitherto published in the Commonwealth of Australia Gazette, and will be issued weekly. From time to time new features are to be inserted, such as notices of opposition proceedings, petitions for extensions, licences, etc., and such miscellaneous matter as may be deemed of public interest.

———

If there are any who doubt the pressing need of legislation to deal with aliens we commend to their attention, the following figures from a recent parliamentary return, showing the number of alien passengers who arrived from the continent (whether in transit or not) at ports in the United Kingdom during the month and two months ending February 28th, 1905, as compared with the corresponding periods of the previous year :—

Ports of Arrival in United Kingdom.	Month of February.		Months of January and February.	
	1905.	1904.	1905.	1904.
London ..	3,323	2,559	7,398	4,722
Grimsby ..	52,55	2,150	4,213	3,330
Harwich ..	933	575	1,359	850
Hull	5,881	2,625	10,096	4,002
Tyne Ports ..	713	510	1,227	1,050
Leith	186	173	337	280
Newhaven ..	736	759	1,502	1,540
Other Ports ..	1,294	957	2,040	1,775
Total ..	15,621	10,308	28,172	17,549

The above totals include aliens in transit, but the number of such aliens cannot be stated, as particulars on this point, are not required by law to be furnished. At some ports, however, it is the usual practice to state on the alien lists the number of aliens known to be *en route* to other countries. The total number so described in February, 1905, was 9,133 compared with 5,135 in February, 1904. In the two months ended February, 1905, the number was 14,605, compared with 7,675 in the two months ending February, 1904. These figures, however, are incomplete for the reasons stated, and many aliens not described in the aliens lists as "*en route* to other countries," are in fact, known by special inquiry, to have been also in transit. The number of sailors included with the aliens not described in the alien lists as *en route* to places out of the United Kingdom in the month of February, 1905, was 1,004, and 924 in the same month of 1904; in the two months ending February, 1905, the number was 1,997, and in the same months of 1904 the number was 1,949. As to the scope of the returns it is further pointed out that the ports from which lists are received are Aberdeen, Belfast, Blyth, Bristol, Cardiff, Dover, Dublin, Folkestone, Glasgow, Goole, Grangemouth, Granton, Greenock, Grimsby, Harwich, Hull, Kirkcaldy, Leith, Liverpool, London, Middlesbrough, Newcastle, Newhaven, Newport, North Shields, South Shields, Southampton, Sunderland, and West Hartlepool. The lists received from Dover, Folkestone, Harwich, Newhaven, and Southampton show only deck passengers, and persons who, after landing, proceed by train as third-class passengers. Although incomplete these returns are sufficient to indicate in a striking manner the large influx of aliens from the continent.

We recently had occasion to refer to the rapidly growing use of motor omnibuses in London. According to the Tramway and Railway World there is promise of a mild motor-bus mania. At any rate, there appears to be some prospect of the motor omnibus business in London being overdone, even in its first days. "During the past month," says our contemporary, "the prospectuses were published of two new motor 'bus companies, each of which promises to have one or two hundred vehicles on the streets by midsummer. A third company of the sort was previously at work, and it also promises to develop. The General Omnibus Company, the Road Car Company, and other existing concerns announced some time ago that they will as speedily as possible have motor 'buses running on all their principal routes. These, of course, will take the place of horse 'buses, but the vehicles of the new companies will be pure additions to the traffic on streets which in many districts are already badly congested. Two things accordingly are in prospect—one that the streets will be more thronged than ever, and the other that the 'buses will not pay." This we fancy is a little pessimistic. There are certain routes in London where additional and more rapid services will come as a boon and a blessing. We trust that the multiplication of motor-buses in the metropolis will also serve to materially hasten the complete overhauling of the traffic regulations.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

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Post free to any part of the world—In advance, 20s. for twelve months.

Sample Copies: United Kingdom, 6d., post free; Abroad, 8½d. post free.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, APRIL 28. — Tramways and Light Railways Association, Meeting, Society of Arts, 8 p.m.: Lecture on "Lubrication," by Mr. William F. Parish.—Staffordshire Iron and Steel Institution —Geological Society of London.

MONDAY, MAY 1.—Society of Engineers, Meeting at Royal United Service Institution, 7.30 p.m.: Paper, "The Parade Extension Works at Bridlington," Mr Ernest R. Matthews.—Society of Arts, Cantor Lecture, 8 p.m.

WEDNESDAY, MAY 3.—Society of Arts, Ordinary Meeting.

THURSDAY, MAY 4.—Chemical Society, Burlington House, 8 p.m.—Civil and Mechanical Engineers Society, Caxton Hall, S.W. 7.30 p.m.: Annual General Meeting, Paper, "Card-Indexing and Filing" Mr. J. C. Osborne.

FRIDAY, MAY 5.—Junior Institution of Engineers, Westminster Palace Hotel, 7 p.m.: Papers, "The Influence of Depth of Water on Speed of Vessels," Mr. Leslie C. Lambert; "Condensing Plant," Mr. James N. Boot.

NEWS ITEMS.

A Glasgow correspondent states that the Egyptian Government has placed an important contract for a large number of heavy and high-speed engines with the North British Locomotive Company, Glasgow.

Messrs. Princeps and Co., of Sheffield, have appointed Messrs. H. Forrest Collin and Co., of 74, York Street, Glasgow, as sole agents for Scotland, for their piston rings, metallic packings, steam dryers, traps, and other specialities.

His Majesty's Government have nominated Sir Francis Mowatt, G.C.B., I.S.O.; Sir Francis Hopwood, K.C.B., C.M.G.; Lieut.-Colonel H. A. Yorke, R.E., C.B.; Mr. W. H. Macnamara, and Mr. W. M. Acworth as delegates to represent Great Britain at the International Railway Congress at Washington.

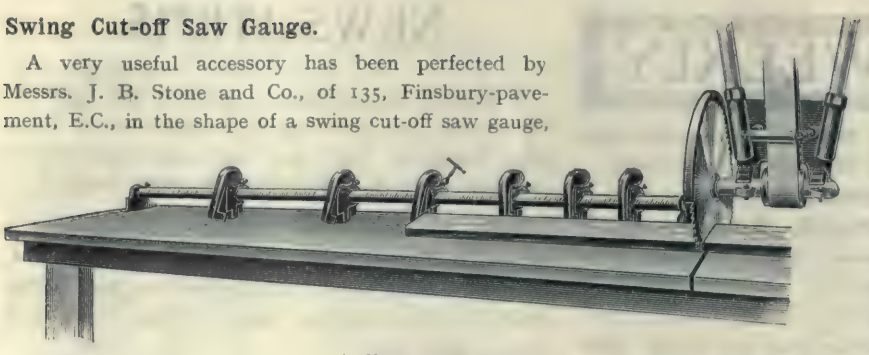
The following have been elected members of the Tramways and Light Railways Association: Messrs. A. W. Bradley, C.E., G. A. Trube, L.C.C., Herbert Jones, A. Charles Devey, H. Harrison, G. S. Robertson, C. Reginald Winn, M.I.Mech.E., T. W. Sheffield, A.M.I.E.E., A. P. B. Brown, M.Inst.C.E., and W. F. Parish, jun.

The first award of the John Fritz Medal which was established by the professional associates and friends of Mr. John Fritz, of Bethelhem, Pa., on August 21st, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress, has been awarded to Lord Kelvin. The medal is of gold, and with it is presented a certificate of the award. The title under which the award is made to Lord Kelvin is "Cable Telegraphy and other General Scientific Achievements."

CONTENTS.

Swing Cut-off Saw Gauge.

A very useful accessory has been perfected by Messrs. J. B. Stone and Co., of 135, Finsbury-pavement, E.C., in the shape of a swing cut-off saw gauge,



A NEW SAW GAUGE.

as illustrated above. A saving of timber and of time are aimed at and where a large quantity of timber has to be cut the advantages of an appliance eliminating guess work and avoiding waste are obvious. An absolute adjustment of the timber on the saw table is provided for and any number of lengths may be cut without having to change the stops, which operate automatically. In an ordinary way it may happen that the sawyer has to cut, say, five pieces from a 16-foot board, each piece being from ½ in. to 1 in. longer than necessary. This of course means that the last piece will be too short and must be cut down for a smaller length or wasted. In the case of mahogany or other expensive stock, the incidental waste is of course proportionally greater. The swing cut-off saw gauge is intended to render small wastages of this kind impossible, the saving working out in proportion to the aggregate of timber cut. The gauge has malleable iron stops hung on an inch square polished graduated steel rod.

Kind of coal	Low Main Peas		Low Main Smudge		Black Shale Peas		Black Shale Smudge		Black Shale Chippings	
	Hand	Bennis	Hand	Bennis	Hand	Bennis	Hand	Bennis	Hand	Bennis
Date of trial	Jan. 28 1905	Jan. 25 1905	Jan. 27 1905	Jan. 26 1905	Jan. 30 1905	Jan. 20 1905	Jan 31 1905	Jan 24 1905		Jan 23 1905
Duration of trial ...(hours)	5	6	5	7	7	8	7	8		7
Class of boiler	Lancashire (Water 7 ft. by house) 30 ft.		Lancashire (Water 7 ft. by house) 30 ft.		Lancashire (Water 7 ft. by house) 30 ft.		Lancashire (Water 7 ft. by house) 30 ft.		Lancashire (Water 7 ft. by house) 30 ft.	
No. of boilers	one	one	one	one	one	one	one	one	one	one
Grate area .....(sq. feet)	30	31	30	31	30	31	30	31		31
Average steam pressure in lbs per square inch...	60	60	60	60	60	60	60	60		60
Average temperature of feed .....(°Fahr)	180	180	180	180	180	180	180	180		180
Total water evaporated, lbs.	24,100	36,900	18,300	53,800	33,500	55,100	19,500	50,000	Could not be fired by hand	34,000
Water evap. per hour, lbs.	4,820	6,150	3,660	7,680	4,786	6,887·5	2,786	6,250		4,857
Total coal consumed, .. lbs.	3,920	4,446	2,430	5,724	5,500	7,398	4,650	6,972		5,115
Coal consumed per hr., lbs.	784	741	486	817·7	785·7	924·75	664·3	871·5		730·7
Lbs. of water evaporated per lb. of fuel	6·15	8·3	7·5	9·4	6·24	7·45	4·2	7·17		6·65
Water evap. per hr. as from and at 212° Fahr., lbs.	5,425	6,539	3,891	8,166	5,088	7,323	2,962	6,645		5,164
Lbs. of water evap. per lb. of coal as from and at 212° Fahr.	6·54	8·82	7·97	10	6·63	7·92	4·46	7·62		7·07
ECONOMICAL EFFICIENCY OF BENNIS STOKER & FURNACE		**34·8%**		**25·4%**		**19·3%**		**70·9%**		
EXTRA WORK OF BENNIS STOKER & FURNACE...		**27·6%**		**109·8%**		**43·9%**		**147·2%**		

REMARKS—The Black Shale Smudge is practically useless for hand-firing, and the Colliery people would not test the Black Shale Chippings on the hand-fired boiler. These Chippings have been thrown away on the pit bank as useless.

REPORT OF SERIES OF COMPARATIVE TESTS BETWEEN HAND-FIRING AND THE "BENNIS" STOKER AND SELF-CLEANING COMPRESSED AIR FURNACE AT THE BABBINGTON COAL CO.'S NO. 3 COLLIERY, TIBSHELF, DERBYSHIRE.

The tests were made on five different classes of coal between January 20th and 31st, 1905.

CORRESPONDENCE.

Little Hulton,

Bolton,

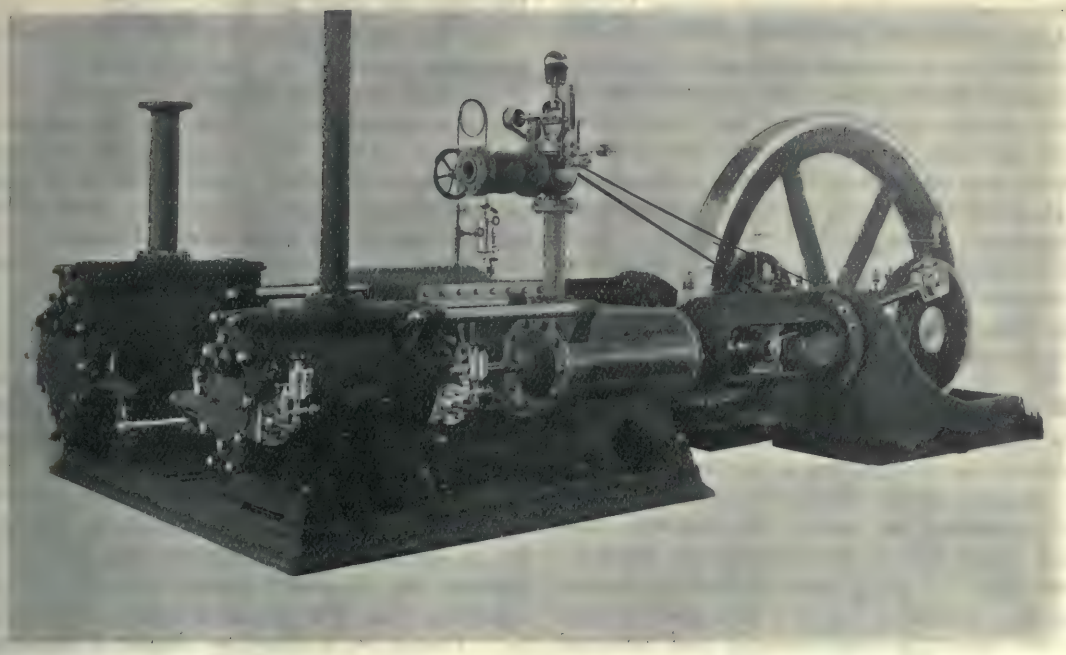
To the Editor of PAGE'S WEEKLY.

DEAR SIR,—We have pleasure in enclosing you a report of a series of comparative tests made at a Derbyshire Colliery, which we think may be of interest to you, the whole of the test being made with very low-grade fuels, and such that used to be entirely thrown away a few years ago; in fact, one of them, the black shale chippings, is at present being thrown away, except what is being burnt on the boilers by our stokers. This means an entire saving of all the coal that they formerly used on the boilers by hand-firing. This is one of the ways whereby the coal supply of England can be extended.

Yours faithfully,

(For Ed. Bennis and Co., Ltd.),

A. W. BENNIS.



THE FRANKLIN AIR COMPRESSOR.

A New Franklin Air Compressor.

The accompanying illustration shows one of the air compressors recently furnished the Pennsylvania Railroad at Altoona, Pa. They were designed and built by the Chicago Pneumatic Tool Company at Franklin, Pa., and belong to what they designate their "C. S. C." class of machines, having compound steam cylinders and compound air cylinders. They are designed to run non-condensing with a boiler pressure of 100 lb. The high and low pressure steam cylinders are 11 in. and 20 in. in diameter respectively, and air cylinders 11 in. and 18 in., with a stroke of 24 in. The capacity of each compressor is 700 cubic feet of free air at a speed of 100 r.p.m.

While graceful in outline the machine is at the same time massive and compact. All bearings are of unusually generous proportions, the pressure per square inch being so reduced as to avoid any tendency to heating, a feature which will be appreciated by those who have had much experience with air compressors. The bearings throughout are provided with removable shells or bronze bushings, with simple but effective provision for taking up wear. The steam cylinders are provided with Meyer adjustable cut-off valves. The main steam valves are double ported, admitting of short ports, and consequent reduction of clearance. The high and low pressure main steam valves are efficiently balanced, reducing friction and wear to a minimum. Both air cylinders are provided with mechanically operated inlet valves of the Corliss type, which are placed in the cylinder heads admitting of close clearance and large port area, with consequent free admission of air. These valves are actuated by the steam cut-off eccentrics, so that four eccentrics drive both steam and air valves, the valve gear being very simple for the work performed. The discharge valves are of the poppet type, being of cup shape, pressed out of sheet steel. The valve seats and guides are removable, and readily accessible for inspection or renewal.

An intercooler, not shown, is provided between high and low pressure air cylinders, which cools air after compression in the low pressure cylinder down to the temperature of the atmosphere. This intercooler, being self-contained, may be placed in any location desired. Owing to the small bore of the cylinders and proportionately long stroke, the percentage of clearance in the air and steam cylinders is very small, resulting in high efficiency and economy of steam. The water jacketing also is much more effective than in compressors of ordinary proportions, having diameters of cylinders about the same as length of stroke. Provision is made for catching all drip from stuffing boxes and bearings.

The governor is furnished with a pressure regulator, which brings the machine to a stop when the receiver

pressure has reached a desired amount, starting it again automatically upon a slight drop in receiver pressure. The governor is also supplied with a safety stop, which will prevent the compressor from running away in case of accident to the governor belt. A rigid box section bed plate extends under the four cylinders to which they are securely doweled, a feature which is a great help in setting the machine and maintaining its alignment.

For the accompanying photograph we are indebted to the Consolidated Pneumatic Tool Company, Ltd., of 9, Bridge Street, S.W., who are agents for the Franklin Air Compressor in this country.

Liege International Exhibition.

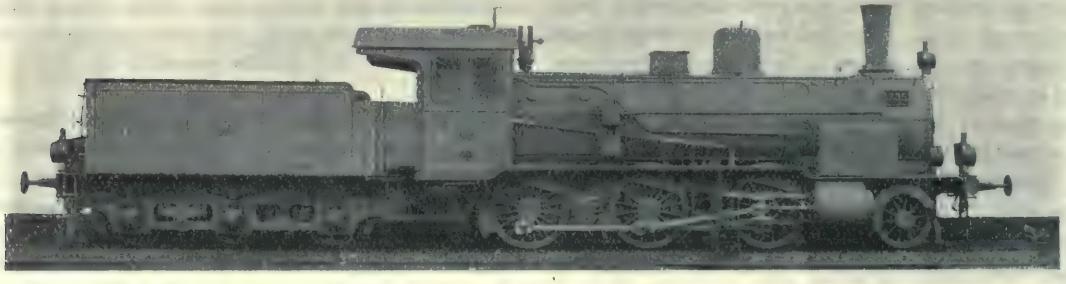
The engineer for the British section of the Liége Exhibition has just returned to London and reports that the work of the British Section is progressing very favourably. A number of exhibitors had already started their installations, and there was every promise that the section would be ready for opening yesterday. Arrangements have been specially made for the benefit of manufacturers and intending exhibitors, who may only decide to come in at the last moment, enabling them to instal their exhibits within 24 hours from the arrival of their machinery. The British Machinery Section has been filled for some time, but owing to the demand for space by engineering firms, the Commissioner-General (Mr. Imre Kiralfy) has succeeded in securing a limited amount of additional space.

The Iron and Steel Institute.

The donations received by the Entertainment Committee appointed in connection with the visit of the Iron and Steel Institute to Sheffield next September amount to £145 10s., and the guarantee fund totals £5,857. The programme of entertainments includes a luncheon and a dinner to be given by the Entertainment Committee, a reception by the Lord Mayor, and a ball at the Institute.

The Institution of Civil Engineers.

The following officers of the Institution of Civil Engineers have been appointed: President, Sir Alexander Binnie; vice-presidents, Dr. Alexander B. W. Kennedy, Mr. W. R. Galbraith, Mr. William Matthews, C.M.G., and Sir Leader Williams; other members of Council, Col. W. P. Anderson (Ottawa, Canada), Mr. C. Napier Bell (Wellington, New Zealand), Mr. B. Hall Blyth, M.A. (Edinburgh), Mr. C. A. Brereton, Mr. R. Elliott-Cooper, Col. R. E. B. Crompton, C.B., Mr. W. J. Cudworth (York), Dr. G. F. Deacon, Dr. F. Elgar, Mr. Maurice Fitzmaurice, C.M.G., Mr. R. A. Hadfield (Sheffield), Mr. G. H. Hill, Mr. C. W. Hodson, C.S.I., Mr. J. C. Inglis, Mr. G. R. Jebb, Sir William Thomas Lewis, Bart. (Cape Town), Sir Andrew Noble, Bart., K.C.B. (Newcastle-on-Tyne), the Hon. Charles A. Parsons, C.B. (Wylam-on-Tyne), Mr. A. Ross, Mr. A. Siemens, Mr. John Strain (Glasgow), Sir John I. Thornycroft, Professor W. C. Unwin, B.Sc., Mr. A. F. Yarrow.



EIGHT-WHEELED SIX-COUPLED GOODS LOCOMOTIVE WITH BOGEY.

One of a number supplied by the Humboldt Engineering Works Company, to the Prussian State Railways for heavy goods traffic.

Chief Dimensions :—

Diameter of Cylinder ...	450 mm.
Stroke	630 „
Wheel diameter	1,350 „
Fixed wheelbase	4,000 „
Total „	6,300 „
Working pressure	12 atm.
Heating surface of tubes ...	130,6 qm.
Heating surface of furnace	10,7 gm.
Total heating surface ...	141,3 „
Grate surface	2,3 „
Weight light	42,720 kg.
Weight loaded	49,000 „

Tender.

Diameter of wheels ...	1,000 mm.
Wheelbase	3,300 mm.
Tank capacity	12 cbm.
Coal capacity	5,000 kg.
Weight, light	16,200 „
Weight, loaded	33,200 „
Wheelbase of locomotive and tender combined	12,750 mm.

Practical Notes on Waterworks Construction.

By George H. Hughes.

A COMMON difficulty in borings is that sand blows are frequently met with. I have experienced great trouble from this cause, and have effectually overcome the difficulty by strainers inserted in the boring tubes.

Where water-power can be obtained within a reasonable distance, pumping can be done in the cheapest manner. For falls where floods seldom occur, and under 12 ft. head, overshot or high breast water wheels may be applied, coupled direct to a set of three-throw pumps without any gearing.

Steam engines possess one great advantage over gas and oil engines for pumping, viz., adjustment of speed to suit varied demands, without complicated gear. Silence in working is often an important condition, and ease of starting is another advantage in favour of steam.

Moderate sized steam engines compounded with surface condensers can be applied to work with a consumption of 2·5 lb. of fuel per i.h.p., the cost being 0·267 penny per i.h.p. per hour, with coal at 20s. per ton. A gas engine, with gas at 2s. 6d. per 1,000 cubic feet, consumes on an average at least 16 cubic feet per i.h.p., costing 0·48 penny per i.h.p. per hour.

The average consumption of oil engines is at least 0·75 pint per i.h.p. the cost with oil at 6d. per gallon being 0·56 penny per i.h.p.

SUCTION GAS PLANTS.

Recent developments in suction gas plants, by which one i.h.p. for 0·10 penny per hour is obtained, certainly make one consider whether by sub-dividing the work and by having two, three, or more such

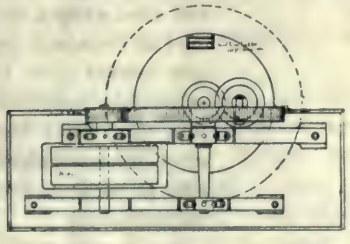


FIG. 2. TOP GEAR 6-IN. BOREHOLE PUMP.

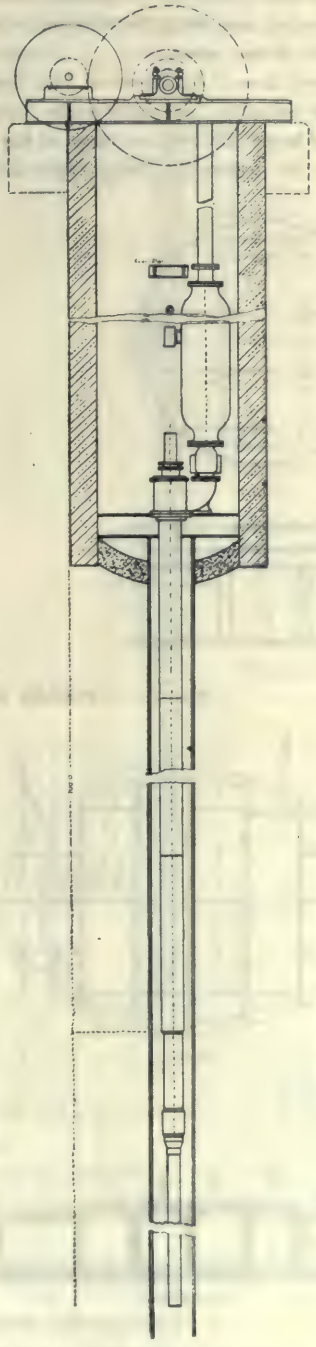


FIG. 1. 6-IN. BOREHOLE PUMP.

plants and engines, some of the difficulties in regard to requirements of output may be got over, faster running pumps with large water-ways and ample valve areas, being specially designed to suit the plant. Silence in working ought to be quite possible. With such an economy in fuel the shorter life of gas engines and gas plants need scarcely be considered, as the saving in fuel would more than cover the cost of renewal in a few years.

If not more than 6 ft. diameter, the Cornish boiler is the most suitable for waterworks purposes, but for boilers of larger dimensions, those of the Lancashire type are to be preferred. Both types are made for pressures up to 200 lb. per square inch, and when used in conjunction with economisers or superheaters, or both, it is doubtful whether any other class of boiler is superior to them.

On the subject of pumps my experience leads to the conclusion that a three-throw pump for economy, smoothness of working, and long life, cannot be surpassed.

There are numerous designs of valves. Clacks, discs and spindle valves may all be classed as single beat, the area of way being limited by the amount of lift. In all these the lift of valve must be at least ·25 diameter of water way to give full area; the weight of water is on the whole area of the valve. A double-beat valve, as the Cornish valve, gives a larger water way for the same extent of lift, and less area for pressure on the valve. Pyramid valves, or cone stepped valves also give a large way for a small extent of opening.

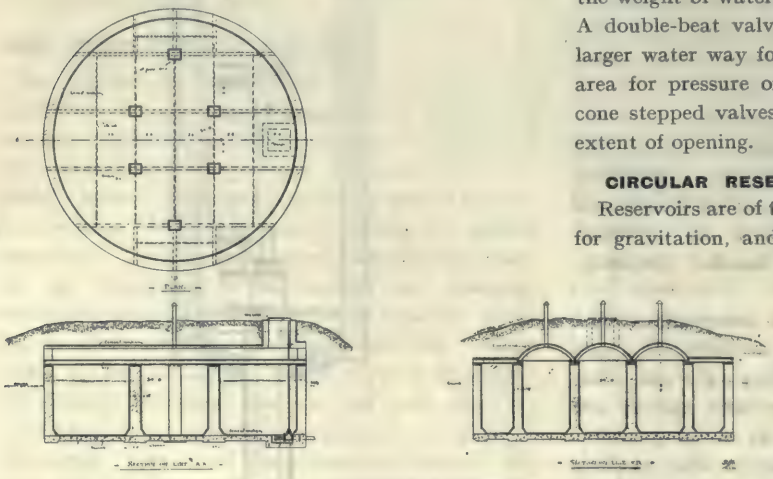


FIG. 3. CIRCULAR RESERVOIR.

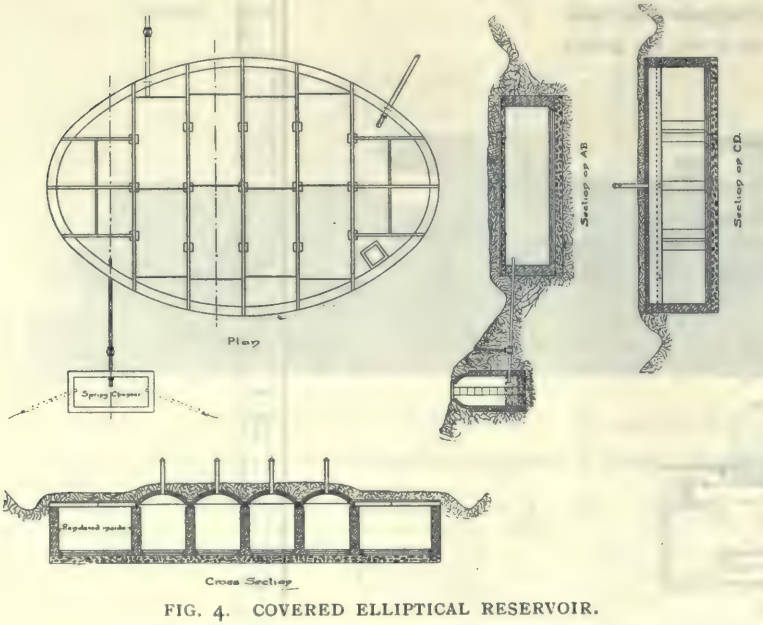


FIG. 4. COVERED ELLIPTICAL RESERVOIR.
Capacity 53,000 gallons.

CIRCULAR RESERVOIRS TO BE PREFERRED.

Reservoirs are of two classes; impounding reservoirs for gravitation, and storage or service reservoirs for pure water from a pumping supply, or for storing filtered water.

Service reservoirs ought always to be covered and protected from accidental or wilful pollution. The cost of covered reservoirs varies from 30s. to £6 per 1,000 gallons in dry strata; if in water-logged ground, they are much more costly. From my own experience in the construction of a large number of reservoirs, chiefly circular, I recommend that form, and that they should be duplicated.

Figs. 3 and 4 show some small circular reservoirs, suitable for dry strata. The interior surfaces are rendered in cement and sand, gauged 1½ in. to 1 in. by ½ in. thick, and finished with neat cement ¼ in. thick. The writer has constructed several with the brick-work laid in 4½-in. rings, dodged to break joint in both the horizontal and vertical joints.

In constructing reservoirs in water-logged strata, the

pressure on sides and bottom have to be considered, both when the reservoir is full and also when it is empty. An instance of this occurs at Dorking Waterworks.

In gravitation works with impounding reservoirs, subsidence of a large portion of suspended matter occurs. In the case of river water, subsidising reservoirs are often employed, the effluent being regulated to pass to filters. Nearly all waterworks filters are mere strainers, no chemical action or oxidation occurring. They are usually downward filters, the water passing through a layer of sand supported by layers of gravel and stones of gradually increasing sizes. The objects to be aimed at in a filter are, to supply the unfiltered water as uniformly over the whole surface as possible; to maintain a depth of water above the sand to secure a given rate of filtration, and to conduct the filtered water away from the bottom of the filter, so that the rate of flow in the pipes and channels is uniform throughout the area. These objects are attained in various ways: by weirs, regulated by valves; by difference in head between water over filter and effluent; and by retarding the flow effluent by valves on outlet mains. The upper surface of sand retains the foreign matters and periodically is removed, the sand being washed and used again.

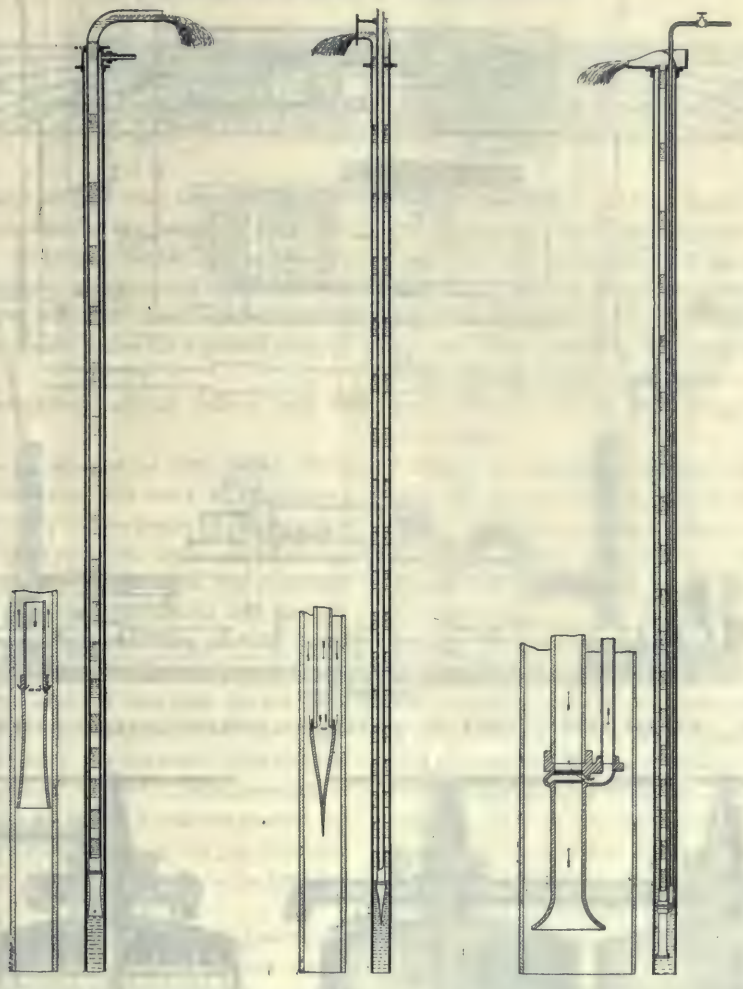


FIG. 5.—IMPROVED HYDRO-PNEUMATIC WATER RAISING METHOD.

Various methods of sand washing are employed, the latest being an improved system, by which a hydraulic jet is directed on to the foul sand, and also raises it to the required height for re-use (fig. 5). Mr. W. Bryan, M.Inst.C.E., engineer to the Metropolitan

Water Board, is the inventor of this apparatus. Another system of filtration is by the use of high-pressure filters, fig. 7, which consist of cylindrical closed vessels with dished ends, having sand inside.

These high-pressure filters are in operation at Crewe for town supply, dealing with 1,164,000 gallons per 24 hours, and at other towns, and it is stated require cleaning twice a week, which is done in a few minutes. It is claimed that the initial cost is ⅓ that of gravity filters, irrespective of land. Up-keep and labour is less. The cost including depreciation, interest on cost, and labour is 0·5 pence per 1,000 gallons in large installations.

Abstract of paper read before the Junior Institution of Engineers.

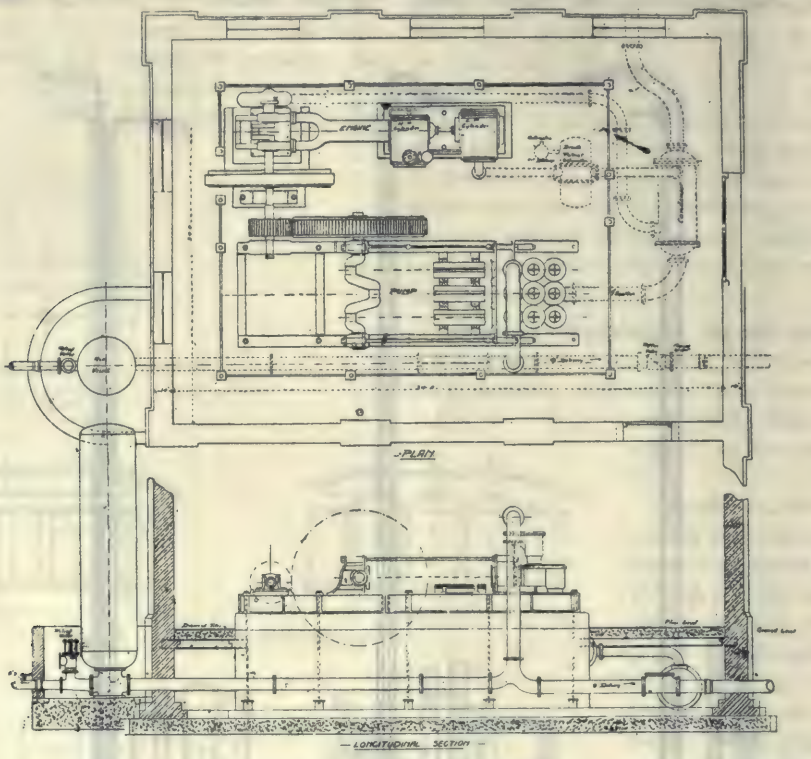


FIG. 6. GENERAL ARRANGEMENT OF PUMPING MACHINERY—DORKING WATERWORKS.

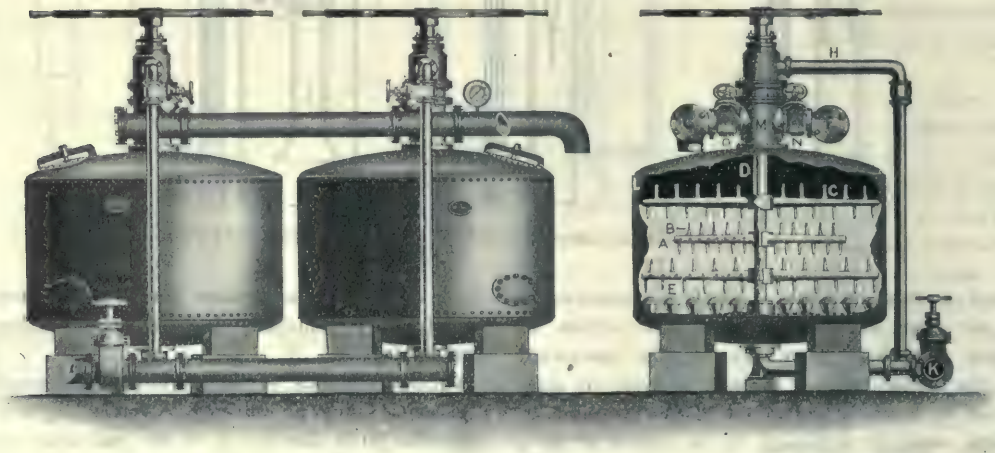


FIG. 7. HIGH PRESSURE SAND FILTER.

Iron and Steel in New South Wales.

A REMARKABLE PROPOSAL.

WE are officially advised that tenders will be received at the office of the Secretary for Public Works up to 2 p.m. on Friday, September 1st next, for the manufacture, supply, and delivery of the whole of the pig iron and rolled iron and steel required by the Government of New South Wales for a period of seven years.

The following conditions, among others, are included :—

The contractor is to establish in New South Wales blast furnace or furnaces, and erect all machinery and plant necessary for the conversion of iron ore into pig iron, and rolled steel and iron, and capable of supplying all the materials included in the contract. The whole of the pig iron supplied to the Government or to the Railway Commissioners of New South Wales, or the Sydney Harbour Trust Commissioners under this contract, and not less than 90 per cent of the pig iron used in the manufacture of the materials to be supplied under the contract, is to be produced from ore raised in the Commonwealth of Australia, but subject to clause 8, the contractor will be allowed to import 10 per cent. of the pig iron used in the manufacture of the materials to be supplied under this contract.

Tenderers must state in their tender the percentage of the total ore, fluxes, and fuel used in the manufacture of the pig iron and materials to be supplied under the contract, which they agree to raise or obtain from deposits in the State of New South Wales.

The contractor will provide all rails and such other materials required for the service of the State as are included in the contract, whether such materials are required for the Railway Commissioners, the Department of Public Works, the Sydney Harbour Trust Commissioners, the Sydney Metropolitan Board of Water Supply, and Sewerage, or any other Department of the State Service.

The Government of New South Wales having decided to invite tenders from persons willing to establish works for the manufacture of steel and iron in the State, it has been thought advisable to supply in pamphlet form, some statistics with regard to the State, and also with regard to the other States of the Australian Commonwealth in which a market exists for similar material to that for the supply of which tenders are invited.

Tables are included showing the total imports of steel and iron into the various States of the Commonwealth of Australia from 1898 to 1902. The total value of imports averaged £2,377,553 per annum exclusive of wire netting, pipes, etc., machinery; or if machinery, etc., is included, £4,517,144. It is difficult to separate the imports on behalf of the Government Departments for those periods from the imports on behalf of private firms, especially in view of the fact that a large quantity of the pig iron imported was used in the local manufacture of pipes by the Department of Public Works. It may be stated, however, that in the four years from 1901 to 1904 inclusive, the Railway Construction Branch of the Public Works Department imported £306,349 worth of rails and fastenings, and the Railway Commissioners £273,267 worth of similar material.

IRON ORE DEPOSITS.

Detailed accounts are given of iron-ore deposits which, by reason of their magnitude, richness, and accessibility, are likely to attract the attention of iron-masters. The accompanying tabulated statement contains a summary of information concerning all the more important deposits known to occur within a reasonable distance of the seaboard.

The two principal iron-ore deposits are situated in the vicinity of the Western Coalfield, viz., at (1) Cadia; (2) Carcoar.

CADIA.

These deposits are distant 12 miles from the Western railway line, and 100 miles from Lithgow Railway Station and coal mine. The ore outcrops at two localities, which are distant from one another about 1½ miles, and it is highly probable that the two outcrops belong to one bed, which is continuous between the two places. The outcrop of the larger deposit is over half a mile long and 600 ft. wide. Some of the ore is of excellent quality, and compares favourably with that used in the manufacture of steel elsewhere in the world. On the other hand, some contains variable quantities of sulphur and copper. It is estimated that there are at least 39,000,000 tons of ore in sight at the two localities (future exploration may show that the quantity of ore present is practically inexhaustible), and of this quantity somewhere between 4,000,000 and 10,000,000 tons are free from objectionable quantities of phosphorus, copper, and sulphur, and are suitable for the manufacture of steel by the cheaper acid processes. The ore consists essentially of hematite, with a small admixture of other ores. Bulk samples taken from tunnels driven across the deposit at a depth of 30 ft. yielded upon assay, in the laboratory of the Department of Mines, the following analysis :—

	"A."	"B."	
Water, at 100 deg. C.	0·41	0·41	per cent.
Iron	60·72	57·08	,,
Silica	9·02	12·72	,,
Copper	0·01	0·08	,,
Sulphur	·035	·124	,,
Phosphorus ..	·010	·022	,,
Carbon Dioxide ..	·024	·020	,,

The ore outcrops along the side of a hill, and could be cheaply won by a system of quarrying.

CARCOAR.

The deposits are 90 miles distant from Lithgow, and within one mile of the railway line. The ore body can be traced by a series of outcrops for a distance of a mile, and in one place has been proved to be 100 ft. wide at a depth of 100 ft. below the outcrop. It is estimated that at least 3,000,000 tons of ore are in sight, and it is probable that the deposit is capable of yielding 10,000,000 tons, or even a larger quantity. The ore consists of a mixture of hematite and limonite. Analyses made in the laboratory of the Department of Mines gave the following results :—

	(1.)	(2.)	
Combined moisture	7·35	8·7	per cent.
Iron	56·49	52·67	,,
Silica	7·88	10·72	,,
Phosphorus ..	·64	·81	,,
Sulphur	·04	·036	,,

State.	Bar and Rod.		Pig Iron.		Plate and Sheet.		Scrap.		Rails.		Galvanized Iron.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
New South Wales ..	13,484	116,903	8,847	27,185	10,803	86,984	6,042	18,677	26,802	161,110	14,702	244,724
Victoria	9,282	75,738	8,505	31,098	5,575	41,466	4,266	13,965	7,464	45,636	14,213	238,737
Queensland	4,059	33,973	2,601	9,877	1,562	12,270	.....	....	Not specified.	66,910	3,662	145,705
South Australia ..	6,310	52,100	5,127	15,752	2,486	18,718	100	265	,,	39,191	6,111	97,930
Western Australia ..	5,047	55,432	2,949†	14,461	2,148	18,810	Included with Pig Iron.		,,	72,021	Included with Plate and Sheet.	
Tasmania	100*	490	Included with Plate and Sheet.		53‡	300	.....	....	,,	6,954*	850	12,500
Totals	38,282	334,636	28,029	98,373	22,627	178,548	10,408	32,907	.....	391,822	44,533	739,596

State.	Wire (Plain).		Wire (Barbed).		Wire Netting.		Pipes.		Machinery.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	.....	£	.....	£	.....	£
New South Wales ..	11,122	90,766	2,353	29,125	.....	46,731	.....	126,004	.....	595,848
Victoria	14,011	124,423	617	7,460	.....	40,948	.....	69,732	.....	487,366
Queensland	1,224	13,076	1,423	17,247	.....	3,038	.....	31,320	.....	178,296
South Australia ..	Not specified	25,339	Not specified.	10,097	.....	36,391	.....	21,096	.....	122,485
Western Australia ..	,,	113,479	,,	7,497	.....	7,261	.....	50,031	.....	582,520
Tasmania	260	2,300	Included with Wire (plain)		.....	800	Included with "Metals" generally—only small quantity.		.....	56,000
Totals	.....	369,383	.....	71,426	.....	135,169	.....	298,183	.....	2,022,515

* As wired from Hobart. † Includes "Scrap." ‡ Includes Pig Iron, as wired from Hobart.

RETURN OF IRON AND STEEL AND MACHINERY IMPORTED INTO THE COMMONWEALTH DURING THE YEAR 1902.

Locality.	Description of Ore.	Estimated Minimum Quantity in tons.	Metallic Iron per cent.	Silica per cent.	Phosphorus per cent.	Distance from Coal.	Tenure.	Remarks.
Queanbeyan	Magnetite	1,000,000	50 to 60	5 to 10	0·01	15 miles by road, 117 miles by train to Mittagong*	Upon C.P. and C.L. lands. Ironstone reserved to Crown	A very valuable ore, suitable for steel manufacture by cheaper acid processes
Breadalbane	Brown ore, with some hematite	700,000	50 to 60	5 to 10	0·098 to 0·248	72 miles by train to Mittagong*	Partly upon private land and partly upon C.P. land, with minerals reserved to the Crown	A good ore, but the phosphorus is high
Chalybeate Spring deposits of Mittagong, Picton, &c.	Brown ore	1,510,000	45 to 55	4 to 16	0·05 to 3·0	Coal underlies deposits	Chiefly upon private land. A few deposits are upon Crown lands	A series of scattered deposits, capable of yielding limited quantities of good ore
Wingello	Aluminous (bauxite) ore	3,000,000	15 to 25	5 to 20	0·02 to 0·2	1 to 3 miles by road, 23 miles by train to Mittagong*	Chiefly upon C.P. lands, with minerals reserved to the Crown	These ores could only be smelted in conjunction with other ores
Goulburn	Brown ore ...	1,022,000	40 to 50	5 to 13	0·1 to 0·5	1 to 10 miles by road, 57 miles by rail to Mittagong*	Chiefly upon private land	A series of scattered deposits
Marulan.....	Brown ore, with hematite	40,000	40 to 55	5 to 13	0·1 to 0·5	35 miles by train to Mittagong*	Chiefly upon C.P. lands, with minerals reserved to the Crown	
Williams and Karuah River districts	Titaniferous magetites	1,973,000	40 to 50	10 to 20	0·04 to 0·2	.....	Partly upon private land and partly upon Crown lands	These are poor ores, containing a high percentage of titanic acid. No present commercial value.
Cadia..	Hematite, magnetite and carbonate ore	39,000,000	50 to 60	5 to 14	·013 to ·051	12 miles by road, 90 miles by train to Lithgow	Private land (owner has absolute right to ironstone)	
Carcoar	Hematite and brown ore	3,000,000	50 to 55	4 to 11	·02 to ·17	1 mile by road, 90 miles by train to Lithgow	Private land (owner has right to ironstone)	
Cowra.....	Magnetite	100,000	60 to 65	2 to 6	·03	8 miles by road, 130 miles by train to Lithgow	Chiefly upon Crown land covered by mineral leases	This ore would compare favourably with the best ores occurring elsewhere in the world. Splendid steel could be produced from the pig iron yielded by this ore
Gulgong.....	Magnetite	120,000	60 to 65	2 to 6	·03	30 miles by road, 90 miles by train to Lithgow	Partly upon private and partly upon Crown land	An excellent ore. Suitable for steel manufacture by acid processes.
Mandurama and Woodstock	Brown ore	609,000	50	3 to 8	·07 to ·33	3 to 6 miles by road, 95 miles by train to Lithgow	Private land	A fairly good brown ore
Mudgee	Brown ore, with manganese	150,000	40 to 54	3 to 10	·80	13 miles by road, 90 miles by train to Lithgow	Crown land, covered by mineral lease not in force	This ore would be valuable for certain purposes to the ironmaster on account of the manganese it contains
Newbridge, Blayney, and Orange	Brown ore and magnetite	150,000	40 to 55	5 to 12	.....	1 to 5 miles by road, about 100 miles by rail to Lithgow	Mainly upon private land	A series of small scattered deposits
Rylstone and Cudgegong	Brown ore	443,000	40 to 55	5 to 16	·05 to ·35	4 to 10 miles by road, 50 miles by train to Lithgow	Mainly upon C.P. lands with minerals reserved to Crown	A series of deposits
Wallerawang and Piper's Flat	Brown ore	2,000,000	40 to 55	5 to 16	·09 to ·52	2 to 10 miles by road, 12 miles by train to Lithgow	Partly upon private and partly upon Crown land	
	Total	53,017,000						

* Mittagong is distant from Illawarra Coal-field about 30 miles. A railway line has been surveyed but not constructed.

TABULATED PARTICULARS OF IRON ORE DEPOSITS, NEW SOUTH WALES.

COWRA.

A deposit of very pure magnetic ore has been discovered at Broula, about eight miles distant from the Harden-Blayney Railway Line. It is estimated that at least 100,000 tons of ore are in sight.

Analysis made in the laboratory, Department of Mines, gave the following results:—

Iron	60 to 65 per cent.
Silica	2 to 6 ,,
Phosphorus.. ..	·03 ,,
Sulphur	Trace.

QUEANBEYAN.

A large deposit of pure magnetic ore occurs at Queanbeyan, about 170 miles from the Illawarra Coalfields. It is estimated that at least 1,000,000 tons of ore are in sight. Results of analysis follow :—

Iron	50 to 60 per cent.
Silica	5 to 10 ,,
Phosphorus	·01 ,,
Sulphur	Trace.

MANGANESE AND MANGANIFEROUS IRON ORES.

Manganiferous iron ores and the richer manganese ores, such as Pyrolusite and Wad, can be obtained in considerable quantities in the Mudgee and Bathurst Districts. The Carcoar iron-ore contains from ·5 to 1·5 per cent. of Manganese, and the deposit includes pockets of rich manganese ores.

COAL DEPOSITS.

The Permo-Carboniferous rocks form the great storehouse of the productive coal seams of New South Wales. They cover an area estimated at from 24,000 to 28,000 square miles, stretching north, south, and west from the seaport of Sydney, and they constitute on account of both the quality and the quantity of the coal contained in them, one of the most important assets of the Colony.

The coal from the three principal coalfields, in which the seams of the Upper Coal Measures are worked, varies considerably in composition ; that from the Newcastle District is most suitable for gas-making household purposes, and contains the least amount of ash, while the coal both from the Southern (Illawarra) and Western (Lithgow) fields is essentially a steam coal. The Southern coal contains less ash than the Western, but the latter is, perhaps, more suitable for smelting purposes than the former.

The Upper Coal Measures have been estimated to contain, in the aggregate, a thickness of about 100 ft. of coal. Of this a thickness of from 50 to 60 ft. has already been proved to be workable.

The Middle or Tomago Coal Measures outcrop in the neighbourhood of East Maitland, and dip under the Dempsey Freshwater Series and Upper Coal Measures. It has been estimated that the aggregate thickness of the coal in the Middle Coal Measures is about 40 ft. Of this total a thickness of about 20 ft. of coal has been proved to be workable.

The Lower or Greta Coal Measures outcrop over an irregular area between West Maitland and Greta, and extending to the north-east and south-west of a line joining those two places. The average aggregate thickness of coal in these measures has been estimated at about 20 ft.

QUANTITY OF COAL AVAILABLE IN NEW SOUTH WALES.

Attempts to calculate the quantity of coal available in any large area of country are always more or less hazardous, as is proved by the wide margin of difference between the estimates, made by various authorities, of the quantity of coal remaining in the British coalfields ; and this is especially true in respect of a comparatively new country like Australia, where the exploratory workings, upon which such estimates must be largely based, are necessarily on a much smaller scale than in the case of Europe or America ; nevertheless, even a very approximate valuation of the coal resources is of interest, more particularly on account of the rapidly-diminishing supplies, and continually increasing consumption of coal in the Old World.

Some years ago the late Mr. C. S. Wilkinson, Geological Surveyor-in-charge, estimated that, within a depth of 4,000 ft. from the surface, the New South Wales coal seams, of a thickness exceeding two and a half feet, are capable of producing 78,198,000,000 tons of coal, allowing one-fifth for loss in working. Subsequently, in 1890, Professor David estimated that the unworked areas of the Palæozoic Coalfields of New South Wales contained between 130,000,000,000 and 150,000,000,000 tons of coal, assuming 4,000 ft. to be the limit down to which coal can be profitably worked, and not taking into consideration seams of less than 3 ft. in thickness. He also pointed out that the quantity quoted was more than equal to all the accessible unworked coal of Great Britain. At the present time we are in possession of rather more accurate information in regard to the areas of our coal-bearing lands, though there is still a great amount of uncertainty as to the average thickness of workable coal which may be expected to underlie them, and also as to the quality of the fuel under considerable tracts as yet unexplored.

Basing our calculation upon the assumption that a thickness of only 10 ft. of workable coal underlies an area of 16,550 square miles, and deducting one-third of the gross weight for loss in working, etc., a total is arrived at of 115,346,880,000 tons of available fuel. If there should prove to be 20 ft. in thickness of workable coal under the whole area instead of 10 ft., then the above figures will have to be doubled; but it is preferable, in view of the uncertainties of the case, to assume a thickness that appears to be reasonably safe.

For further details, samples of coal analysis, an account of the coke manufactured in the Colony and the valuable beds of limestone distributed over it, we refer readers to the pamphlet which can be obtained from the Agent-General for New South Wales.

Refractory Materials for Furnace Linings.

By E. Kilburn Scott, M.I.E.E., A.M.Inst.C.E.

THE production of electric-furnace products as refractory materials for furnaces, kilns, ovens, etc., as well as for electric furnaces themselves, is likely to develop into an important branch of electrometallurgy.

Refractory materials may be roughly divided into: Carbon, for the highest temperatures; silicon carbides, made in the electric furnace, such as carborundum, siloxicon, and amorphous or soft silicon carbide; crystallised magnesite, made in the electric furnace; ordinary firebrick, magnesia brick, cement clinker brick, etc., for the lower ranges of furnace temperature.

It is proposed to deal only with the second and third groups, and especially with the use of electric-furnace products as furnace washes.

CARBORUNDUM AND SILOXICON.

Probably the first material to be used in this way was carborundum, Engels having first sugggested its use as a wash in 1899. Although introduced so recently, it has already established quite an excellent reputation. For ordinary furnace kilns, etc., the carborundum is ground up very fine, and mixed in the proportion of three parts by weight of carborundum to one part by weight of silicate of soda (waterglass). After thoroughly brushing the freshly set firebrick to get rid of dust, etc. (the mixture does not stick readily to a surface which has been already fired), the carborundum is painted on to the depth of about half a millimetre. It is then left for about twenty-four hours to dry, and afterwards the firing started up gradually. The result is that a layer of carborundum becomes cemented over the whole surface of the firebrick lining, cracks and all, and if properly done it adheres quite soundly.

The tempertature limit to the use of carborundum is reached when it decomposes according to the equation $SiC = Si + C$., the silicon escaping as vapour whilst the carbon remains as graphite. When the temperature is so high that this decomposition occurs, there appears to be no refractory material that can be used, except carbon, and the best form of carbon for the purpose is charcoal. Possibly further study of electric-furnace products may produce other highly refractory materials.

Siloxicon has a density of 2·73, and is of a grey-green colour when cold, and light yellow when heated to 300 deg. F. It has the property of forming a coherent mass when ground fine, moistened with water, and moulded into a form and fired. It is very refractory, and has a neutral action with both acid and basic slags, and is indifferent to all acids except hydrofluoric acid, which attacks it slowly.

With proper mixtures of silica and carbon it forms in the electric furnace at about 2,500 deg. C. It is insoluble in molten metals. At fusion temperatures it is decomposed by free alkalies, and in the presence of free oxygen it oxidises at about 1,500 deg. C. In a neutral or reducing atmosphere it is unaffected until its temperature of decomposition is reached, which is about 3,000 deg. C. Upon decomposition the oxygen is set free, the carbon and silicon uniting to form

silicon carbide, which is in itself a very refractory material.

Although to a certain extent self-binding when heated to a high temperature, in commercial work it is advisable to add some form of bond to siloxicon. If it is desired to make up articles which can be baked thoroughly before use, the Siloxicon Company recommend the addition of about 2 per cent. of finely-powered alumina, the mixture to be baked at a temperature slightly below that at which siloxicon oxidises. In certain cases 5 per cent. of finely powdered, refractory, plastic, non-alkaline clay can be used in addition to the alumina, this giving increased strength without detracting from the refractoriness of the article as a whole.

If it is desired to use siloxicon as a lining to some form of furnace, the material is tamped into place and baked in the furnace itself; for this purpose it may be mixed with either silicate of soda or coal-tar. In the former case a solution of silicate of soda having a specific gravity of 1·1 should be used. This can be mixed with the siloxicon until the desired consistency is obtained, and can be made up into a thin wash and applied as a paint where it is merely desired to protect some other form of lining.

AMORPHOUS SILICON CARBIDE.

When describing the carborundum furnace before the Franklin Institute in 1893, Acheson referred to a white or grey-greenish looking shell, surrounding the zone of carborundum crystals. After being heated with hydrochloric acid, caustic soda, water, hot oxygen, and hydrofluoric acid, it gave the following analysis: Silicon, 65·42; carbon, 27·93; ferric oxide and alumina, 5·09; calcium oxide, 0·33; magnesium oxide, 0·21.

It is known as amorphous silicon carbide. As silicon carbide is a much better heat-conductor than ordinary firebricks, it is best not to use it alone, otherwise there may be serious loss of heat, but it should be used as a wash over other bricks; indeed, this may be said to be true of all silicon carbides.

When a silicon carbide is put directly into place in the furnace, where it will not have to undergo any serious mechanical strains, the mixture may consist of the powdered silicon carbide in a solution of hot glue in water. Silica is usually present in commercial silicon carbide, and by fusing at high temperatures it strengthens the article considerably. When no free silica is present, Fitzgerald has found that an article made up with the glue solution becomes weak and crumbles after use; it is, therefore, advisable to add silica in the form of a small quantity of infusorial earth. When the lining is not exposed to very high temperatures the silicon carbide may be mixed with a dilute solution of sodium silicate, having a density of 1·03 to 1·05 but the higher the temperature the smaller must be the amount of sodium silicate used.

Gas-tar makes a fairly satisfactory bond. In the proportion of 4 to 1 a residue of carbon is left in the article, which tends to diminish the insulating properties of the silicon carbide. Where the conditions are such that neither oxidation or current leakage is to be feared, a tar bond is satisfactory, giving articles of considerable mechanical strength.

When an article of great mechanical strength is required, and the use of tar is objectionable, the article may be made by causing the particles of the silicon carbide to frit together by oxidation.

CALCINED MAGNESITE AS LINING MATERIAL.

Ordinary calcined magnesite, generally in the form of brick, is now recognised as the best material for lining basic open-hearth furnaces, cement kilns, etc. It may be employed to advantage wherever high temperatures and chemical reactions are usually detrimental to dolomite, chromite, and silica. America uses large amounts of magnesite for steel furnaces: whereas in England dolomite is chiefly employed, although magnesite is coming into use, even though it is double the price. The distinctive characteristics of a magnesite lining are durability, freedom from moisture, and silica, and resistance to corrosion when exposed to the action of basic slags and metallic oxides. These qualities make the living cheaper than most others in the long run.

About two years ago the writer carried out some original experiments in Meraker, Norway, with a view to thoroughly shrinking magnesite in an electric furnace. The furnaces were of the Siemens and Halske type, built for the manufacture of carbide of calcium on the intermittent system, and they were supplied with current from 900-kilowatt three-phase generators, driven by water turbines. The material on which the writer worked was native magnesite brought from Salem in Southern India,* where it is found in a remarkably pure state.

The writer found that it was possible simply to pass the magnesite down the chutes in the same way as the raw materials for making carbide of calcium. When once the arc was fairly started, the raw magnesite

* These magnesite deposits have been known to the natives for many generations, and they use it for plastering the inside walls of houses. Being absolutely fireproof and self-binding, it is an excellent material for the purpose. It has been suggested to make partition walls for houses from it by smearing on to a textile fabric as a base and letting it set in a corrugated shape. The samples of partition walling which the writer has seen promise well.

could be fed in at a fairly rapid rate, and completely shrunk, that is to say, all the CO_2 driven off, without the assistance of any carbon or other material.

After a two hours' run with 3,500 amperes at 65 volts a block, about 15 inches cube was obtained which was practically pure crystalised magnesite. When broken into pieces with a sledge-hammer the material showed a fine crystalline structure with a beautiful iridescent colour, and it had evidently been in a semi-plastic condition. Attempts were made to mould the half-shrunk material into bricks, and then treat these in the electric furnace, but with poor success.

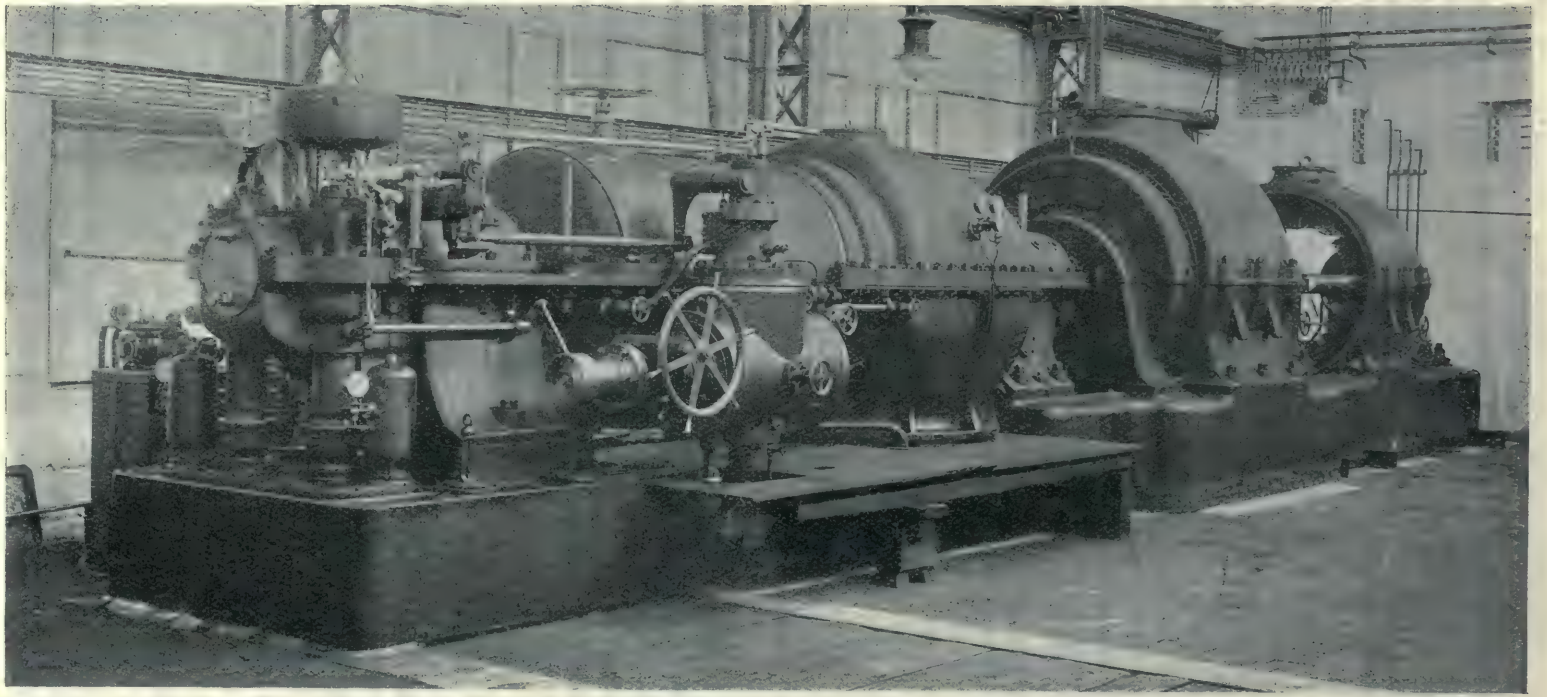
On returning to England in November, 1902, the writer found that Mr. W. Deighton, of the Deighton Patent Flue and Tube Works, Hunslet, was trying carborundum as a wash in the furnaces, and also on the refractory blocks surrounding the water-gas flame when heating steel tubes. He showed Mr. Deighton the electrically-shrunk magnesite, and suggested that it would probably be as good and considerably cheaper than carborundum. It has now been tested as a wash over the firebrick lining of a carbide of calcium furnace, and it was found that the bricks lasted for two hundred hours without repair, whereas the unprotected bricks required repair after a five hours' heat. There is no doubt that the crystallised material, without further preparation than being crushed to suitable dimensions, will prove of special value as a refractory material in metallurgical practice, and an important point in connection with its use as linings for electric furnaces is that magnesite, unlike lime, does not form a carbide with carbon.

In the large open-hearth steel furnaces at the Homestead Steel Works, Pittsburg, the writer found that large quantities of ground calcined or partly shrunk magnesite were used for the underbeds of the furnaces, and it is probable that the electrically-shrunk material would be found to be still more effective.

Abstract of a paper read before the Faraday Society.

A BOILER EXPLOSION.

The necessity of paying careful attention to accessories was emphasised in a startling manner by an explosion on board the s.s. *Duneric*, which has recently been the subject of an inquiry under the Boiler Explosions Act. The accident occurred in the early morning, when the vessel was in the Bristol Channel, between Newport and Cardiff. There seems to have been nothing specially calling for remark in the construction or conditions of the boiler, which was of the cylindrical multi-tubular type, 12 ft. 7 in. diameter by 10 ft. long. It was constructed of steel for a working pressure of 165 lb. per square inch. There was fortunately no loss of life. The furnace crowns of the starboard boiler collapsed, the combustion chamber backs and top plates buckled slightly between the stays; the back tube plates were forced nearly over the tube ends, and the tube holes, from which steam escaped through the furnaces into the stokehold, were distorted in some cases fully three-eighths of an inch. When the explosion occurred there was 150 lb. pressure on the boilers and the starboard boiler water gauge showed full glass. The gauge however, proved to be in a defective condition; a quantity of muddy deposit was found in the bottom part of the water pipe, and the hole in the water cock on the boiler end was all but closed between the plug and the pipe flange. The gauge cocks on the column were also not in good working order; they had asbestos packed parallel plugs, with $\frac{1}{4}$ in. square holes in them, which were partially blind through the plugs not being entered far enough into the shells. The steam cock was only $\frac{1}{16}$ in. clear and the hole in the water cock was half blind, apparently these cocks were repacked shortly before the explosion. The investigation showed that the explosion was due to the defective water gauge.



RECENT TURBINE INSTALLATIONS.—(IX.)

The latest turbo-electrical plant constructed by Messrs. Brown, Boveri and Co., of Baden. This has been built for the Rheinisch-Westfählisches Elektrizitätswerk A. G. of Essen, Germany. It is a turbo-tandem generator 10,000 h.p., 1,000 revs., 11 atm., with three-phase generator, 5,000 kw., 5,000 volts, 50 cycles, and continuous current dynamo 1,500 kw., 530-600 volts.

The Minister of Commerce and Industry Bill.

MR. Louis Sinclair's Minister of Commerce and Industry Bill recalls Lord Rosebery's suggestion of a government by business men. The Bill calls for the establishment of a Bureau of Commerce and Industry under the control of the Minister aforesaid appointed from the Privy Council by His Majesty. The Ministry proposed, would consist of "a permanent council of experts representing various trades and industries and elected for a definite period of five years." If not an officer of State already receiving a salary, the Minister would receive a salary of £5,000 per annum and would be provided with a secretary, assistant secretaries and other officers and servants as determined by the Ministry with the sanction of the Treasury.

The powers and duties of the Ministry would include certain functions now exercised by the Board of Trade, the Local Government Board, the Home Department and the Board of Agriculture. The Ministry of Commerce would be empowered to undertake the collection, preparation, and publication of statistics and useful information relating to trade, employment, emigration, railway and canal facilities and traffic, harbour and dock accommodation and shipping. They would make, or aid in making, such inquiries, experiments, and research, and collect, or aid in collecting, information in the interest of commerce and trade. They would also establish a department of manufacturers, to foster and develop manufacturing interests, and would organise a department of corporations, to investigate the management of corporations, joint stock companies, etc. The Ministry of Commerce and Industry would also establish a department of commercial treaties and tariffs and a department of commercial missions and foreign agents. The latter would be required to reside in important commercial centres and would enjoy all the privileges of consular officers.

The Acts of Parliament in which the new Board would be substituted for the Local Government Board are:—

Markets and Fairs Clauses, 1847; Public Health, 1875 (Section 167—Approval of Tolls); Markets and Fairs (Weighing of Cattle) Act, 1887 (the whole Act); The Alkali, etc., Works Regulation Act, 1881; and 1892. The Acts in which the new Board would be substituted for the Home Office are: Fairs Act, 1871; Fairs, 1873; Truck Act Amendment, 1887; Truck Act, 1896; Factory and Workshop, 1901; Coal Mines Regulation, 1887; Coal Mines Regulation, 1896; Quarries Act, 1894. The Acts of Parliament in which the Board of Commerce would be substituted for the Board of Agriculture are: The Markets and Fairs (Weighing of Cattle) Act, 1887, 1891; and the Diseases of Animals Act, 1894.

The Powers, etc., of the Board of Trade transferred to the Board of Commerce, include the following Acts: Patents, Designs, and Trade Marks, 1883, 1888; Patents, 1902; Conciliation, 1896; Cotton Statistics 1868; Corn Returns, 1882; Merchant Shipping, 1894, Gates and Level Crossings, 1839; Railway Regulation, 1840, 1842; Cheap Trains, 1844; Railway and Canal Traffic, 1854, 1888, 1892, 1894; Abandonment of Railway, 1850; Railway Construction Facilities, 1864; Railway Companies Arbitration, 1859; Board of Trade Arbitration, 1874 (Part II. of the above Act) Harbour Transfer, 1862; Railways Clauses Consolidation, 1863; Railway Companies' Powers, 1864; Railway Companies' Securities, 1866; Railway Companies, 1867; Regulation of Railways, 1868, 1871, 1873, 1889; Abandonment of Railways, 1869; Railways (Powers and Construction), 1864; Amendment Act, 1870; Railway Regulation, 1873, 1893; Railway Returns (Continuous Brakes), 1878; Cheap Trains, 1883; Light Railways, 1896; Tramways, 1870; Railway Employment (Prevention of Accidents), 1900; Railways (Electrical Power), 1903; Act of the Forty-sixth year of George the Third for the Preservation of the Public Harbours of the United Kingdom; Harbours, 1814; Harbours, Docks, and Piers Clauses, 1847; Preliminary Inquiries, 1851; Harbour and Passing Tolls, 1861; General Pier and Harbour, 1861; Amendment Act, 1862; Anchors and Chain Cables 1899; Weights and Measures 1878; Weights and Measures, 1889.

OUR WEEKLY BIOGRAPHY.

SIR EDWARD J. REED, K.C.B., F.R.S., M.P.

SIR EDWARD J. REED, (Vice-President of the Institution of Naval Architects), was born at Sheerness in 1830. He was educated at the School of Mathematics and Naval Construction, Portsmouth, and subsequently served in the Royal Dockyard, Sheerness. Leaving the Government service, he became the editor of the Mechanics' Magazine, in which position he first became known as an authority on naval architecture.

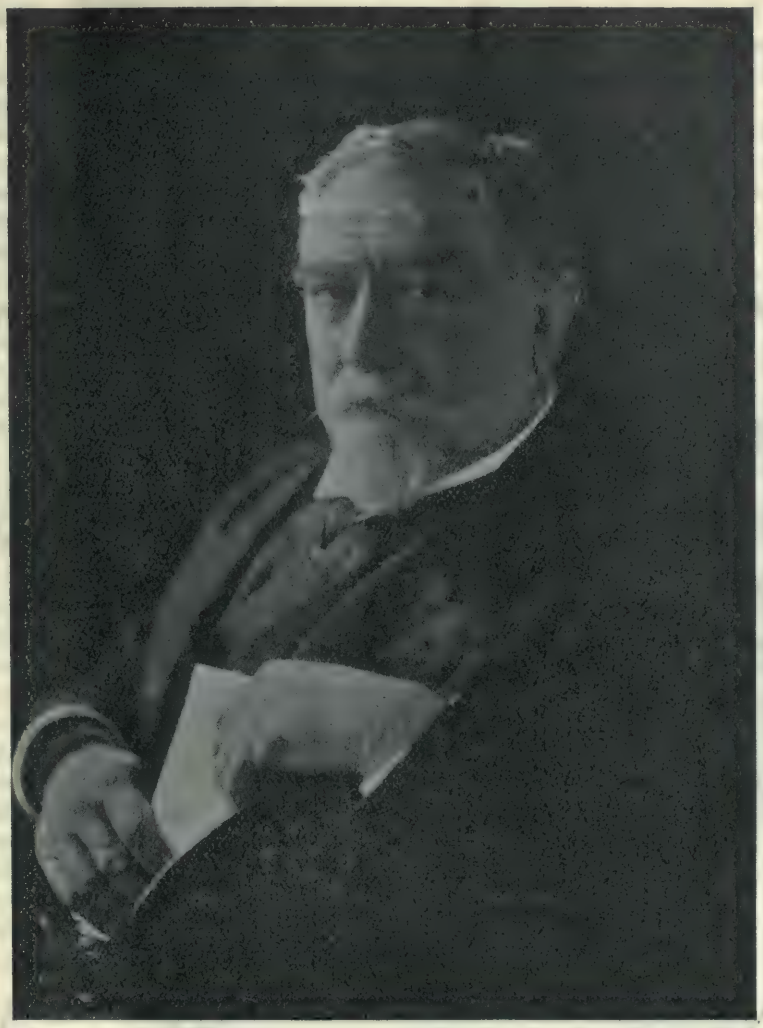
Sir Edward was one of the founders of the Institution of Naval Architects in 1860, and for a number of years he acted as secretary to that body. He submitted proposals to the Admiralty concerning the construction of iron-clad ships, which were adopted in practice and were so highly approved by the Board of Admiralty that their author was appointed Chief Constructor of the Royal Navy in 1863.

During the time he held that office, Sir Edward designed iron-clad ships and vessels of war of every class for the British Navy, and also—with the consent of the Government—some iron-clad frigates for the Turkish Navy. In consequence of his objections to rigged sea-going turret ships with low freeboard, of the *Captain* class, and of the favour that type of ship found with the Board of Admiralty, he resigned his office in July, 1870, a step rendered remarkably significant by the lamentable capsizing of the *Captain* two months later.

Since his resignation, he has designed iron-clad vessels and other classes of warships for various foreign powers, the latest of which are H.M.S. *Triumph* and *Swiftsure* (late *Libertad* and *Constitucion*), which, as our readers will remember, were originally built for the Chilian Navy, but were eventually purchased by the British Government, and which have proved themselves to be among the most powerful battleships afloat. Sir Edward has, for many years, been naval Architect and inspecting engineer to the Government of India and to the Crown Agents for the Colonies. The two latest ships for the former have just been completed under his supervision. They are the troopship *Dufferin*—the largest of her kind in the world—and the pilot cruiser *Fraser*. For the Crown Agents for the Colonies he has designed and supervised the construction of a great number of vessels of all types.

Sir Edward Reed is the author of "Shipbuilding in Iron and Steel," "Our Iron-clad Ships," "Our Naval Coast Defences," "Japan; Its History, Traditions, and Religions," and "Stability of Ships," as well as of many papers contributed to the scientific institutions with which he is connected.

Since his retirement from the Admiralty, he has received numerous recognitions of his professional skill and ability, including various decorations from foreign powers. He was created a Knight Commander of the Bath in 1880. In 1874 he was returned to Parliament as Member for the Pembroke Boroughs, which he represented till 1880, when he was elected for the important constituency of Cardiff, which he represents at the present time. During the summer of 1883 he was deputed by the Government to investigate and report upon the *Daphne* catastrophe on the Clyde. In February, 1884, he was entrusted with the presidency of the committee appointed to inquire into the subject of the load-line of vessels. In 1894 he was appointed chairman of the parliamentary committee to inquire into the manning or undermanning of merchant ships. He is a member of the Council of the Institute of Civil Engineers and a member of the Institute of Mechanical Engineers.



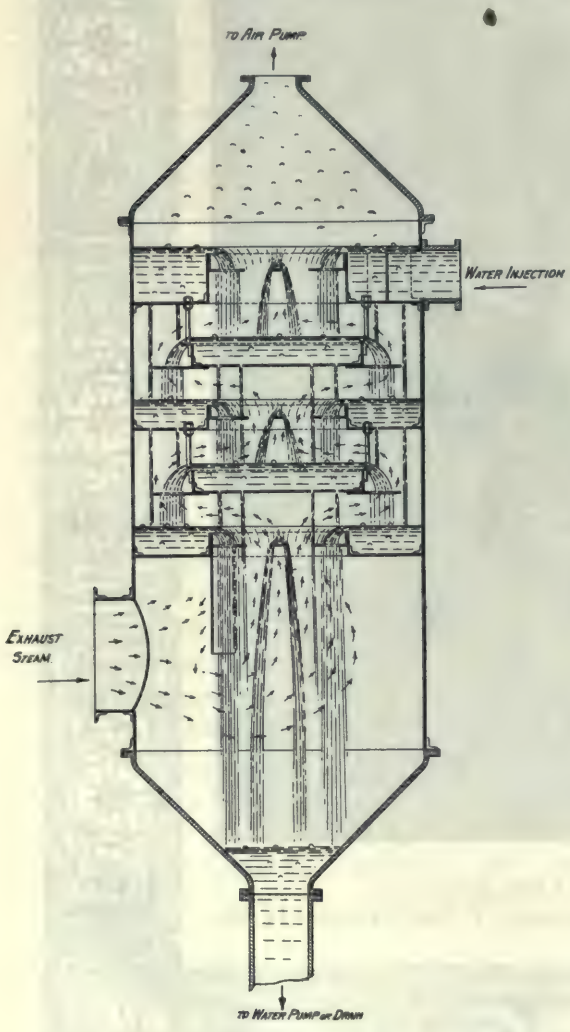
SIR EDWARD J. REED, K.C.B., F.R.S., M.P.

Who was one of the founders of the Institution of Naval Architects in 1860.

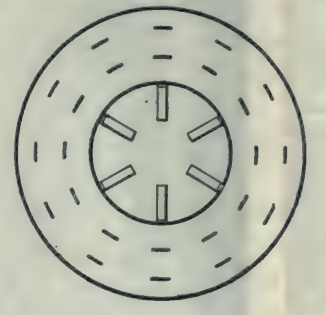
Photo by Elliott and Fry.

AN IMPROVED CONDENSER.

The illustration shows an improved form of counter-current jet condenser made by the Mirrlees Watson Company of Glasgow. The condenser casing is of cylindrical form, of cast iron, or built up of steel plates for lightness, and is fitted with a series of trays arranged alternately around the circumference and

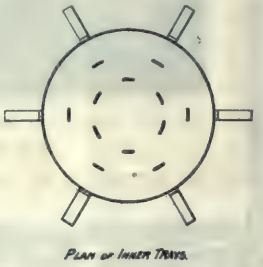


at the centre of the condenser. The cooling water enters the top part of the condenser and falls into and overflows the series of trays in the form of sheets or cascades. The exhaust steam entering at the lower part of the condenser rises and comes into complete contact with these cascades of water, the air and non-condensable vapours being drawn off at the top of the condenser, while the cooling and condensed water is drawn off at the bottom. In order to give a maximum contact surface and also a free passage for the vapours in their course through the condenser, the edges of the trays are serrated or are fitted with bars, as shown in the illustration, to break up the water; the bottoms of the trays are also provided with elongated slots to give additional streams of cooling water. These



Plan of Outer Trays.

special forms of serration to the tray edges and the arrangements of bars, etc., are protected by patents granted to the company. The resultant effects of the arrangement are: (1) That the cooling and condensed water leaves the condenser at a temperature within 2 deg. to 3 deg. of the temperature of the exhaust steam, thus requiring a minimum quantity of cooling water. (2) The air and non-condensible vapours leave the condenser at a temperature approximating to the temperature of the inlet cooling



Plan of Inner Trays.

water and therefore at a minimum volume. (3) By giving a free passage to the vapours in their course through the condenser, it is possible to obtain an absolute pressure at the exhaust inlet practically the same as that at the outlet to air pumps. It is claimed that these three points are essential to obtaining the highest degree of efficiency.

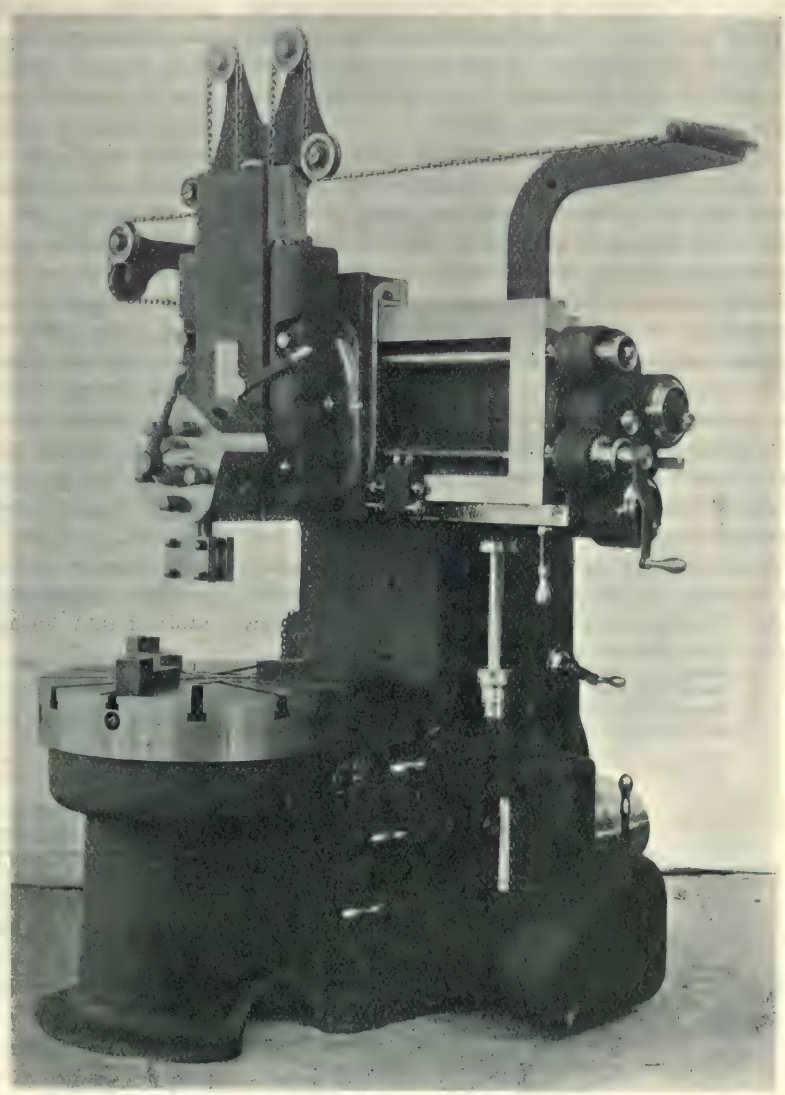
NEW 34-in. BORING MACHINE,

BY THE GISHOLT MACHINE COMPANY, MADISON, WIS., U.S.A.

This is a machine of particularly stiff construction, all the parts being especially heavy and rigid. Like the other vertical mills which are being built by this firm, it has particularly broad bearing surfaces. There are a few essential differences, however, the principal one lying in the headstock. In all but the machine illustrated, the friction back geared headstock has been introduced, but on the 34-in. machine a four-step cone pulley drive is used and back gears are thrown in and out by means of a positive clutch operated by lever. The levers for the control of the machine are very conveniently located to the operator when standing in his customary position.

The machine is fitted with the feed tripping devices similar to those used on the larger sizes, by means of which any feed may be positively and automatically stopped at any predetermined point. The feed screws are all fitted with micrometer index dials reading to 1–1,000 in.

The table may be universal and combination chuck-fitted, with three movable jaws, or a plain table with radial "T" slots and independent jaws. The two-speed counter shaft provides sixteen table speeds. The mill is provided with eight changes of feed, all feeds being operated either by power or by hand. The photo here shown illustrates the machine with a screw cutting attachment and a swivel turret head. The spindle drive is of the spur pinion variety, the spindle resting on broad, self-oiling babbitted surfaces. The machine is also made with a plain head and without screw cutting attachment.



NEW 34-IN. BORING MACHINE.

The Effect of Oil on the Ultimate Strength of Boiler Furnaces.

BY D. B. MORISON, M.I.N.A.

(*Continued from page* 846.)

IN view of the fact that all marine engineers, and particularly superintendent engineers, fully understand and appreciate the dangers arising from oil in boilers, it is a mystery why a winch exhaust tank still continues to be fitted on shipboard (fig. 1). The office of this tank is to receive the exhaust steam from the winches, to separate the oily water therefrom for use as feed water in the boilers and to allow the cleansed steam to be discharged up the waste steam pipe. It would be difficult to find a parallel to this system as an example of engineering folly.

There is no justification whatever for the expenditure of capital to provide such an apparatus, and any heat there may be in the comparatively small amount of oily water trapped in the exhaust tank, is more than counterbalanced by the decreased efficiency of the heating surface in the boiler due to oily scale. The alternative is to employ an auxiliary condenser, which condenses all the steam from the winches and other small engines (fig. 2). This system is universal in passenger steamers, and is now being rapidly recognised as commercially correct for cargo boats, as it results in economy of coal, better steaming, and reduced boiler cleaning expenses. The oil used for winches is generally not of a high grade, and consequently forms an emulsion with the feed water, a condition rendering any system of mechanical filtration, without previous chemical treatment, exceedingly difficult, if not impossible. It is much safer to extract the oil from the exhaust steam from the winches and auxiliaries before it enters the winch condenser, this system being the direct antithesis of the exhaust-tank system, as, instead of wasting the cleansed steam and utilising the oily drainage as feed water, the process is reversed, to the advantage of both the boiler and the shipowner. As an exhaust steam oil separator, to be efficient, must be of large capacity, and with a view to economising weight and space, the two processes of steam cleansing and condensing have been carried out in one combined apparatus. This combination also permits of an evenly distributed flow of steam into the condenser throughout its entire length, thereby materially increasing the efficiency of the cooling surface. The usual method employed is to condense at atmospheric pressure; the advantages being simplicity of mechanism, no air pump being required, a high temperature of feed water, and a high efficiency of circulating water.

In a straight tube condenser, on the "Contraflo" principle, the feed water temperature is about 180 deg. F. and the circulating discharge about the same, and, as the surface efficiency and the water efficiency are both very high, a much smaller condenser and a less quantity of water are required than in ordinary practice. Considerable advantage is obtainable by utilising such an apparatus at sea, for cleansing the

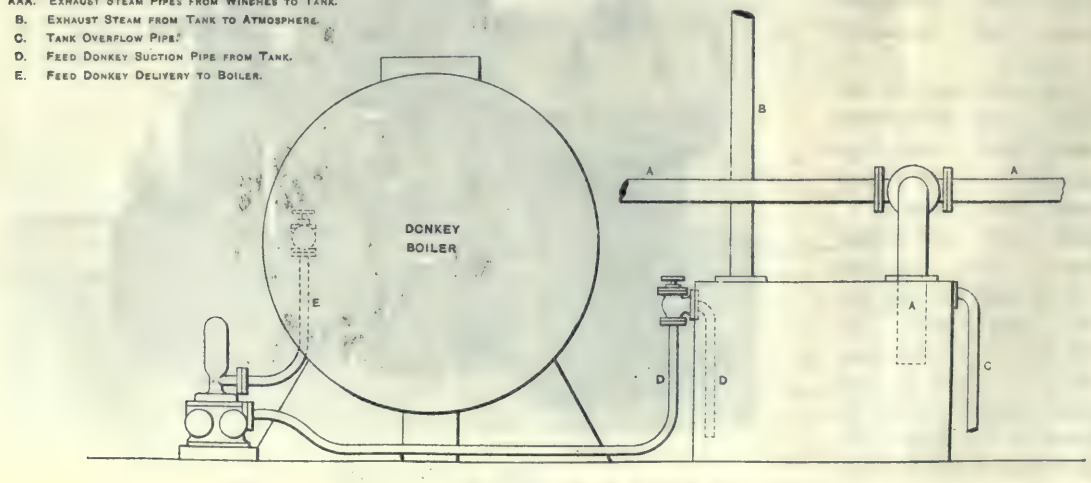


FIG. 1. ORDINARY ARRANGEMENT OF WINCH EXHAUST TANK.

steam from the steering engine and other deck auxiliaries which may be in use during the voyage, the water of condensation being drained into the hotwell and the oily drainage either filtered or wasted, depending on its quantity. This arrangement also affords facilities for ascertaining the steam consumption of steering engines, etc., and is productive of instructive and occasionally of startling results. Samples of water from an apparatus in ordinary work exhibit a most marked contrast between the oily drainage and the clean feed water.

INTERNAL LUBRICATION.

Another phase of this question is the quality and characteristics of the oil used for the internal lubrication of cylinders, and the swabbing of piston rods and valve spindles. Many superintendents use no oil for internal lubrication by direct means, but only indirectly by swabbing the rods; others use direct internal lubrication either constantly or intermittently.

If oil is used for internal lubrication either by direct means or indirectly by swabbing the rods, a large proportion emulsifies with the water condensed in the cylinders, and may be trapped by automatic water drainers connected to the steam receivers of the engine. A sample of receiver drainage water collected in ordinary work by a Geddes pulsator, was shown to contain no less than 140 grains of oil per gallon in emulsion besides a considerable quantity of free oil. Trapping the oil in this manner before it enters the condenser also has the advantage of keeping the tubes clean and so maintaining their efficiency.

With regard to marine engines using saturated steam, my own experience is that with suitable piston rings continuous internal lubrication is unnecessary, and with metallic gland packing a minimum amount of swabbing is required for the rods.

The object of a piston ring is to maintain steam tightness with the least possible pressure between the surfaces, a condition which also requires a minimum of lubrication. A device for this purpose, which has been very successful in practice, consists of an endless steel ring which fits into a recess in the piston ring and limits its expansion to a pre-determined amount. Experience has shown that a very small allowance for expansion is necessary, and as the limit ring ensures and maintains cylindricity, steam tightness is obtained with a minimum of friction and wear; the arrangement also gives the engineer every facility for inspection and adjustment.

QUALITY OF OILS.

Whatever may be the system employed, there is no doubt whatever that the quality and suitability of the lubricating oil are of vital importance, so that the commercial instincts of a non-technical buyer of oil may very severely handicap the engineer who is responsible for the efficiency of the machinery on which it is used. A high price may be given for an inferior cylinder oil, but a high-grade oil cannot be obtained except at a high price, by reason of the costly processes of manufacture.

Given a sufficiently high temperature, any oil will vaporise, and this evaporation will be at a maximum when the oil is in a finely divided state. For this reason the conditions prevailing in a cylinder demand an oil which will not vaporise until a temperature has been reached considerably in excess of the temperature of the steam; the excess being necessary from the fact that oil, subjected to the conditions in a cylinder shows greater changes than the same oil does when heated to a much higher temperature in small bulk in the open air. If the oil vaporises below the steam temperature, it cannot perform its functions as a lubricant, and is simply swept by the steam into the condenser, where it emulsifies with the feed water.

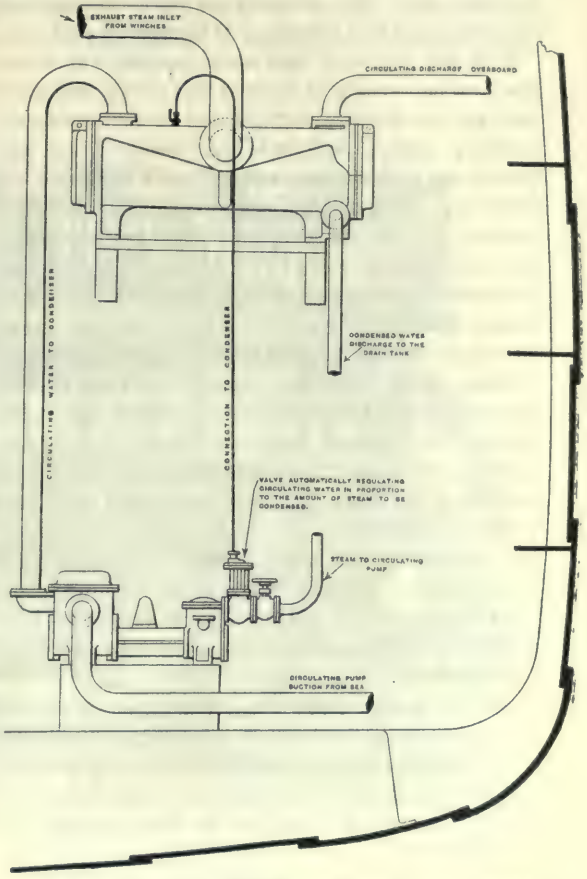


FIG. 2. ARRANGEMENT OF WINCH CONDENSER FITTED WITH CONTROL VALVE.

When oil is fed into a cylinder, it should not only be unaffected by the temperature, but should distribute itself amongst the steam in such a manner as to effectively lubricate the surfaces with which it comes in contact. If, on the other hand, the oil is so sluggish as not to associate with the steam, it is either local in its action, or it is blown through the engine practically unused. Cylinder oil should, therefore, possess the greatest fluidity consistent with the conditions and requirements prevailing, and yet have sufficient viscosity to perform its lubricating functions on the parts to which it attaches itself and which, in the case of cylinders, are always more or less wet. In order to increase the lubricity of pure mineral oil, and to assist it to adhere to the cylinder surfaces, some manufacturers add a very small percentage of saponifying oils, but for very high temperatures, and especially for superheated steam, it is very questionable whether a straight high-grade oil is not the safer to adopt. Other essentials for a good cylinder oil are that it shall not carbonise or gum, and that it shall be entirely free from acid. The demands are most exacting, and can only be met by a mineral oil of the highest grade.

It is not the very high-grade mineral oils which give serious trouble in boilers, but cheap, low-grade oils, and particularly the oils used in lubricating the auxiliary engines and deck machinery. These oils, emulsifying with the feed water, cannot be filtered out unless the water be first chemically treated; so in ordinary practice they are discharged into the boiler, and there become a source of inefficiency and danger. A cylinder oil for marine engines should be of a known brand, preferably obtained direct from a known manufacturer and the feed water should be filtered.

Steam from auxiliary engines, steering engines, winches, or other deck machinery, should not be discharged into a main condenser direct, but into an auxiliary condenser, and then only after the oil has been separated from it. Such precautions, as I have indicated, constitute a necessary standard of engineering practice, if maximum commercial success is to be attained, as only by their strict observance can the efficiency of the heating surface of the boilers be maintained, and the risk of furnace accidents reduced to a minimum.

Boiler furnaces afford an apt illustration of the fact that progress in mechanical engineering is achieved only by a judicious combination of theory and practice, or the application of fundamental principles to the complex situations that are so often revealed by experience.

From a paper read before the North-East Coast Society of Engineers and Shipbuilders.

Institution of Mining and Metallurgy.

The following new members have been admitted to the Institution of Mining and Metallurgy since March 9th, 1905: W. A. Caldecott, Transvaal (transfer); Donald G. Forbes, Dorset; Thomas Girtin, London (transfer); J. A. Leo Henderson, London (transfer); T. Graham Martyn, Truro (transfer); W. E. Clifton Mitchell, Transvaal; Joseph G. Oliveri, Sicily; Cyril E. Parsons, York (transfer); Charles B. Saner, Transvaal; William T. Saunders, London; Hans H. Smith, Norway; P. B. Waugh, London (transfer); Walter H. Weed, Washington, D.C.

Important Opening for Motor Engineers.

The Post Office authorities are not generally credited with any great partiality for innovations, but they have done all in their power to encourage inventors to produce a motor suitable for the carriage of mails. For three or four years past they have used motor-vans as letter carriers, and their motor service is being rapidly extended. Reliability is the first condition of everything connected with the Post Office work, says the Society of Arts Journal, and there is a big fortune for the firm that first turns out a motor van that fully meets the stringent conditions of the Department.

The Circulation of Water in Boilers.

The difficulty with which steam-bubbles disengage themselves from the under side of a horizontal or moderately-inclined flat surface is well known. In a less degree this applies also to the lower half, or perhaps more correctly the lower third, of the exterior of a tube. In a stationary loco-type boiler this holds good, but the boiler of a locomotive engine in rapid motion and subjected to all the jolts and jars incidental to travelling at high speed, gains considerable advantage from the shaking it receives and the thereby greatly facilitated disengagement of the globules. In fact there are cases on record where upon the instant of moving out of the engine-shed, a locomotive boiler has suddenly, and without other assignable cause, exploded with great violence, undoubtedly through the sudden movement flashing into steam a layer of water which, from want of circulation, had been lying quiescent in a globular condition in contact with overheated surfaces.

A Technical Bureau.

Our attention is called to the formation of "The Technical Bureau," at Prince's Chambers, John Dalton Street, Manchester, chiefly for the purpose of lending technical books to annual subscribers by means of the postal service. It is to be open for the issue of books early in May.

MOTOR NOTES.

MOTOR OMNIBUSES.

SEVERAL firms now make a speciality of commercial vehicles of the type used by omnibus companies and railways. Fig. 1 shows a double-decked omnibus, similar to those now running between Oxford Circus and Hammersmith. This is a 24-h.p. four-cylinder motor with mechanical inlet valves, variable inlet cam and two independent sets of electric ignition. In the event of any temporary trouble through ignition, such as foul sparking plugs, there is no necessity for any delay on the road as is usually the case; the driver has only to switch on the second set of ignition and proceed on his journey, leaving the first to be attended to on reaching his destination. The car is fitted with three speeds forward and reverse actuated by the same lever, and two independent sets of powerful brakes. Transmission is by a leather-faced clutch with chain-drive. This is the type of omnibus that many railways and corporations are taking up at the present time.

One or two points of interest may be noticed in detail. The carburetter is of special type, and is connected with the governor, which automatically regulates the supply of gas to the engine by means of a throttle valve. The variable cam fitted to the inlet not only allows the stroke of the inlet valve to be varied, but also the time of lifting, which means that at the driver's will the inlet valve can be only just opened at the beginning of the suction stroke or at any period of the suction stroke of the engine. Through this appliance is obtained an extremely flexible engine (the number of revolutions can be varied from 120 to 1,000 per minute) and the quality of gas is not subject to any alteration, while the consumption of fuel

FIG. 1. DOUBLE-DECKED OMNIBUS MANUFACTURED BY MOTOR CAR EMPORIUM, LTD.

is reduced to a minimum. The control of this variable cam is effected through a small lever on the steering column.

With the exception of the tricycle motor all the engines fitted by the Motor Car Emporium, Ltd., are water-cooled, and for this purpose a combined water reservoir and cooler is fixed in front of the bonnet. The cooling is obtained by a gear-driven rotary pump and the circulating water is constantly cooled by a fan driven from the engine. All the main bearings, both of the motor and transmission, are oiled by forced lubrication, which is automatically regulated according to the speed of the car.

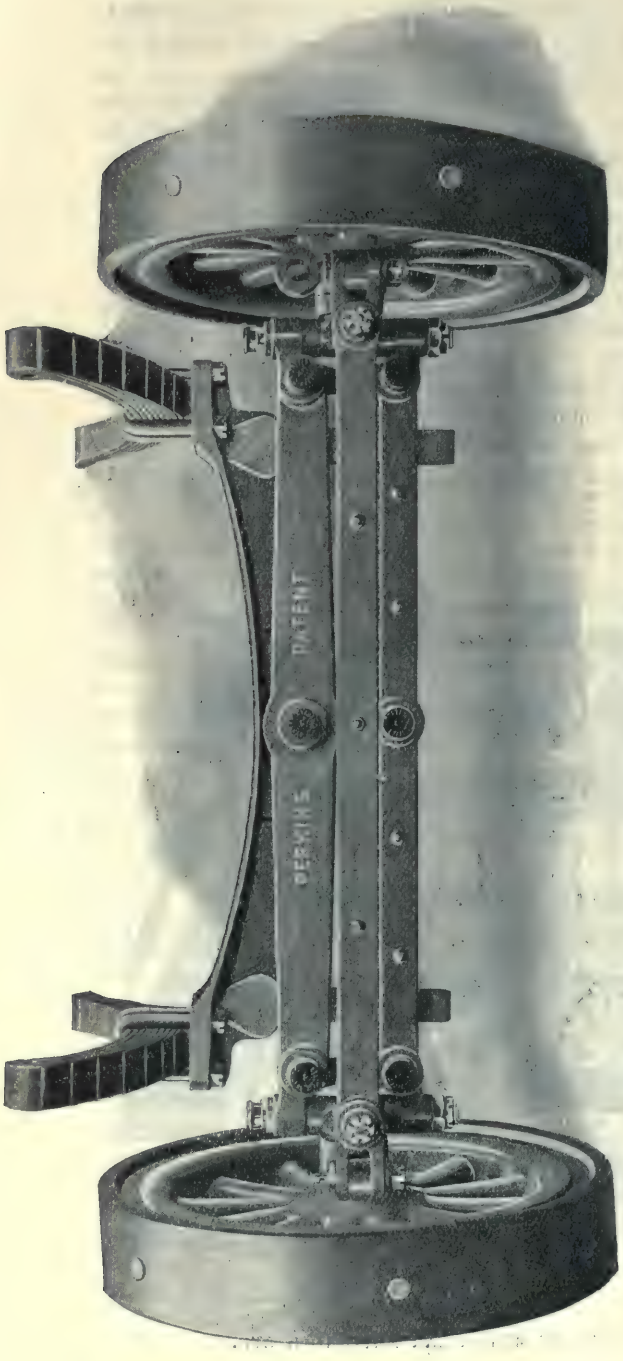


FIG. 2. VIEW SHOWING NORMAL POSITION OF FRONT WHEELS AND HERCULES AXLE.

The frame of the heavy vehicle is of compressed steel or armoured wood. The wheel base of the car is specially long and wide to ensure smoothness of running, to give the passengers plenty of room and comfort, also providing a large loading surface. The hind wheels in this type are set back as far as possible, thus reducing enormously the wear and tear on them. The four semi-eliptic springs are very long and should be most flexible, reducing vibration and rendering the riding of the car both easy and luxurious. Helmet oilers on all the small movements and the various connecting links of the springs add greatly to the comfort of the car in driving over rough roads. Best artillery-pattern wood wheels are fitted.

HERCULES OSCILLATING AXLE.

One of the specialities of the Hercules Company, whose heavy vehicles are well known, is the patent multi-tubular fire-tube steam generator, which is claimed to be a most economical and efficient steam generator for motor vehicles. It is so arranged that the hot gases pass from the fire-box through the vertical tubes into the top combustion chamber, thence by diagonal tubes deflected into the casing chamber which surrounds the whole of the upper portion of the boiler, thus giving a very large heating surface, with the minimum waste of heat. Another feature in the Hercules design is the patent oscillating axle, with parallel motion illustrated in fig. 2.

This appliance enables either wheel to pass over an obstacle without distorting the frame of the wagon, thereby eliminating all cross-winding of shafts and gearing, breakage of pipe joints, and other injurious effects.

The parallel motion which is introduced compels the front wheels to maintain at all times the same vertical plane, and to track with the back wheels. Another Hercules feature is the composite road wheel. For this wheel is claimed all the advantages of a solid steel wheel without its disadvantages. The body of wheel is one complete steel casting, the spokes are tubular, with a rim of channel form, into which are fixed wooden felloes, and hooped with a steel tyre. The hub is bushed with bronze. The chain drive is fixed to the facing at the outer end of spokes.

Vertical Shaft-Sinking on the Witwatersrand.

By H. Fraser Roche.

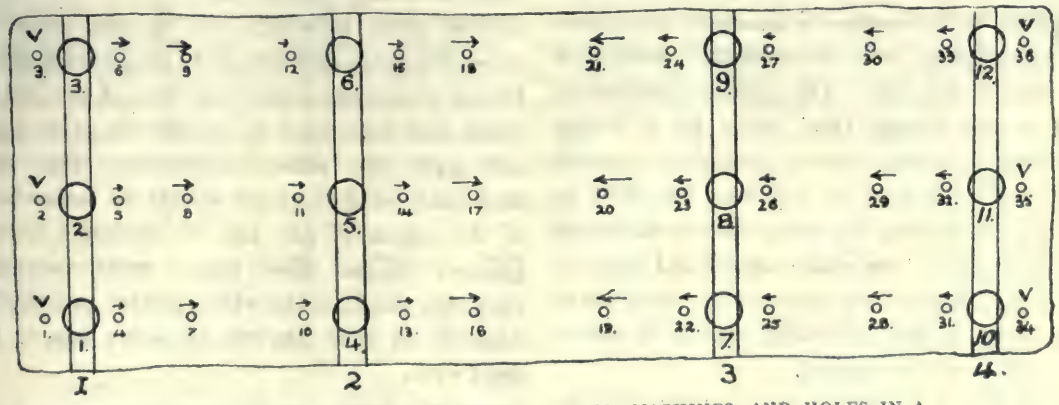
(*Concluded.*)

THERE are some interesting facts to be learnt from the Cinderella Deep shaft. This was sunk mostly by machines, four only being used at one time and the average monthly sinking during 1903 was 96½ ft. This shaft has been remarkable for the low consumption of dynamite—·602 lb. per ton of rock hoisted, and the very low cost during that period, viz., £20 per foot. As this is the only shaft on the property, no other, I believe, being contemplated at present, a brattice wall is being carried down to overcome the difficulty of ventilation when developing and stoping commence. An excellent job is being made of this with pitch pine boards 1¼ in., tongued and grooved. The effect even now is highly satisfactory, all smoke and gas being out a quarter of an hour or twenty minutes after blasting.

AN IDEAL METHOD.

I will now try to depict an ideal method and gear for the sinking of our future deep level vertical shafts. First, the permanent steel or wooden headgear to be used should be erected on suitable foundations. The first 100 ft. to 150 ft. of sinking would of necessity be slow, until the solid formation is properly entered. A few feet more according to its nature should be excavated in this, and the collar set definitely, placed in position, and the first bearer set fixed in deeply seated hitches in the solid at the bottom, and the timber from the collar set to the bearers hung, close lagged and blocked up.

One of the most important matters to my mind coming next, is the tamping in of 20 ft. to 30 ft. good solid clay directly above the first set of bearers, and this should stop all surface water entering the shaft. In the meantime the permanent winding engines should have been laid down to be used in future sinking operations; and then we come to a very vital question, whether skips or buckets are to be used. I think everyone will agree with me in deciding at once for the former. They undoubtedly



PLAN OF SHAFT, SHOWING POSITION OF BARS, MACHINES, AND HOLES IN A VERTICAL SHAFT, 32 FT. × 9 FT.

afford greater safety, quicker hauling, and better facilities for helping the pumps with the water, and I can confidently affirm that 20 ft. more a month can be done with skips. The second and fourth compartments should be used for hauling, the first for a winch if necessary, the third kept idle, and the fifth for ladders, air and pump mains. The method of sinking will greatly depend on the quantity of water encountered. For a dry shaft, hand labour is the quickest, cheapest, and generally the most suitable, and I should imagine that in the future some excellent footages will be done by Chinese hammer boys, provided suitable contracts are set them. For a system, that employed at the Jupiter is excellent, but I would suggest the blasting of some of the end and side holes first, as I have found that the sump and easers will blast better and break more effectually when slightly loaded with the ground from the blasting of these holes. When water enters into the question I am sure machines will sink faster, as it is no longer possible to sink in benches.

Then comes a question on which so many authorities differ, viz., What size of machine shall we use? I pin my faith absolutely to 3¼ in. or 3 in.; for when a hard bar is encountered, two or three hours are easily lost in the drilling, when small machines are in use. Another matter which causes great difference of opinion is the number of machines which can be successfully and economically employed in a shaft of this size. The various experiments tried at the Village Deep make me a strong advocate of twelve. Over a period of a month we found a net gain of one hour per shift in the time of drilling by using twelve machines instead of eight. Six white miners and twenty-four native helpers can successfully manipulate these and the plan of drilling should be somewhat as follows (see figure).

Holes Nos. 5, 13, 15, 22, 24, 32, may often be dispensed with, but that will entirely depend on the ground to be broken. In elevation the sumps of holes 16, 17, 18, should practically reach sumps of holes 19, 20, 21, and the sump of a hole such as 14 should be within 3 ft. of the sump 17. If this is carried out no trouble will be experienced as regards blasting the timber. The blasting, cleaning and timbering cannot be bettered at Village Deep. In almost all deep level mines of to-day water will probably be met with, if not in the shaft, in the future mining operations, and I would advocate at the time of sinking a Cornish pump being carried down as sinking operations are extended. The size of the pump would depend on the quantity of water estimated by the surrounding conditions and data from outcrop mines. It will be necessary to cut sumps about every 300 ft. vertically, and place balance bobs about every 500 ft. In conjunction with this pump a sinking pump of sufficient size to deal with the water encountered would be carried down with the sinking.

The lighting of a sinking shaft should be done as at Cinderella and Village Deeps, that is by two clusters of electric lamps 32 c.p., four to six lamps in each cluster, and suspended from the timbers. I do not care for ventilating pipes, but would rather have a brattice wall as put in at Cinderella Deep. The cost of such is approximately 10s. per foot.

The matter of comparing costs of different shafts is a very difficult one, owing to the many diverse ways in which the various items of expenditure are grouped, and I cannot remember having ever come across the costs of two shafts which had been kept in exactly the same way, and gave the same information. The cost of a shaft sunk by hand should be somewhere in the region of £20 and by machines about £30 per ft., but these figures must naturally vary very much, as the whole matter practically depends on what amount of water has to be dealt with.

Read before the Chemical, Metallurgical, and Mining Society of South Africa.

INSTITUTION OF NAVAL ARCHITECTS.

(*Continued from page* 873.)

LONGITUDINAL BENDING MOMENTS AMONG WAVES.

Mr. F. H. Alexander read a paper on "The Influence of the Proportions and Form of the Ships upon their Longitudinal Bending Moments among Waves."

The following is an abstract:—

It is usual to express the maximum bending moment as a function of the product of the weight and the length of the vessel; and the function factor in the form of a divisor. In the case of simple illustrations, it is easy to see that this divisor varies directly as draught when beam and height of wave are constant; varies directly as height of wave when ship's form is constant; and is unaltered by alteration of beam when draught and height of wave are constant.

For a given wall-sided vessel and a given height of wave, a divisor, constant for all draughts, could be obtained if a constant or standard weight of displacement were used, namely, that of a volume whose plan is the shape of the waterplane, and whose depth is equal to the height of the wave. As far as the statical calculations are concerned, a box-shaped vessel shows no rise or fall when among waves whose length from crest to crest is equal to her own length; but the rise and fall is obviously greater the finer the form of the waterplane.

In order to investigate the influence of fineness of form, calculations were undertaken, some results of which are given in our illustrations. The calculations were made for two series of forms; the first consisting of flat-bottomed wall-sided forms, of varying degrees of longitudinal fineness only; the second of ordinary ship forms. There was determined for each vessel at several draughts: First, the maximum statical bending moment when across the crest, across the trough of a wave of length equal to that of the ship, and of height equal to one-twentieth of its length. Secondly, the statical bending moment divisor based on a "standard displacement" of the nature referred to above. Thirdly, the reduction of bending moment due to the modified buoyancy of a trochoidal wave, expressed as a percentage of the maximum statical bending moment. And lastly, the extent of the rise and fall.

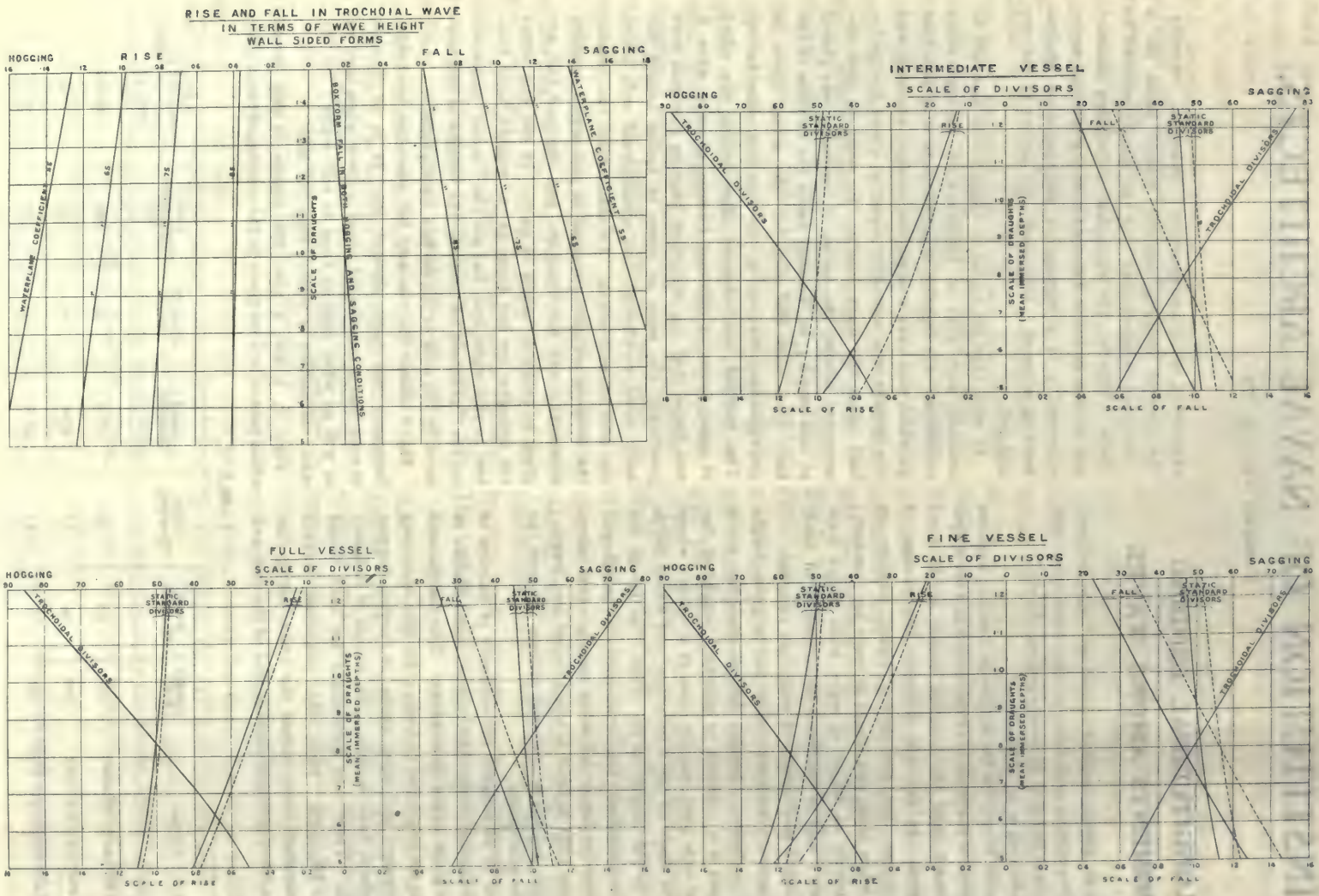
In each case the curve of weights was assumed to coincide with that of buoyancy in the still-water condition; the lightest draught dealt with was that at which the wave trough just touched the keel, and the deepest was a draught equal to about one and a half times the wave height. In order to save unnecessary labour, the centre of buoyancy was placed at mid-length; in the ship forms the sections of the body plan were the mean of the actual forms of corresponding stations in the fore and after bodies. This method was adopted after testing the effect of using forms of different fineness of ends, when it was found that the maximum bending moments were practically the same as those of bodies having the same mean co-efficient, but symmetrical ends about the axis at mid-length. To standardise the results, the divisors are given instead of the actual bending moments; and the draughts, and rise and fall, are given in terms of height of wave. In the ship forms the draughts are not those of the vessel's body from keel to still-water line, but are the "mean immersed depths" obtained by dividing the volume of displacement by the area of the surface waterplane.

Fig. 1 shows the rise and fall when the trochoidal buoyancy has been allowed for. It is of interest to note that a box-shaped vessel is lower when hogging as well as when sagging than in still water; by the static calculation it neither rises nor falls.

Figs. 2, 3, and 4 give the results of ship forms whose particulars are given in the accompanying table.

TABLE I.

Fig.	Type.	Length B.P.	Beam Moulded.	Depth Moulded.	Load Draught.	Block Co. Load	Load Waterplane Co.	Ratio, Waterplane Co. / Block Co.
2	Full cargo steamer	340	45	30	23·5	79	·88	1·11
3	Intermediate liner	500	54	38	29·0	·73	·85	1·16
4	Fast passenger liner	550	63	43	28·5	·64	·77	1·20



FIGS. 1, 2, 3, AND 4 SHOWING RISE AND FALL IN TROCHOIDAL WAVE AND LONGITUDINAL BENDING MOMENTS WITH DIFFERENT SHIP FORMS.

THE LINE OF FUTURE INVESTIGATION.

The author pointed out that in the case of a vessel whose design brought about such a distribution of weights as to reduce the moments due to pitching and to heaving to a minimum under all her conditions of service, it seemed justifiable to make allowance for the reduction of bending moment caused by the trochoidal pressures. Unless this was done, they would be unfair to a vessel so designed, and particularly to one the shortness of whose voyage lessened the disturbance of centres of weights due to consumption of bunker coal. In the case of vessels whose variations of loading and draught were great, the extra bending moments due to heaving and pitching were much more likely on occasion to counterbalance or even exceed the trochoidal reduction; and it was therefore reasonable to exclude this reduction. It was unlikely that a vessel crossing waves at right angles to the line of their crests would roll to large angles, but the effect of transverse inclination on the bending moment should not be ignored—it varied in relation to the angle of inclination, so that there was an increase as compared with the upright in both hogging and sagging conditions. It was desirable that experimental data should be obtained on the question of fluid resistances to heaving and pitching, so that the extent of these movements, and the bending moments caused by them, could be estimated on the lines laid down in the paper read by Mr. Read before the Institution in 1890 and in the paper read by Captain Kriloff in 1898.

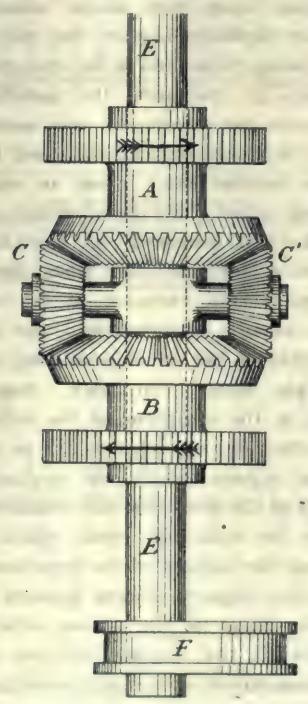


FIG. 5. ILLUSTRATING GOVERNOR DESIGNED TO PREVENT VIBRATION.

Dr. Bruhn called attention to the fact that the distribution of the weights in the hull, including the machinery and cargo, had an enormous effect on the bending moment compared with little differences in the form of the vessel.

Mr. Alexander said he agreed with Dr. Bruhn, but he had dealt with the matter as he had done advisedly. They could take no proper account of bending moments until they separated that part which was due to the weight from that which was due to the form. During sa voyage a ship altered the distribution of her weight by the consumption of coal and so on, but she never altered her form excepting in so far as draught altered it, and, therefore, she did not alter under any given draught that part of the bending moment which was due to her form.

PREVENTING VIBRATION.

A paper on this subject was read by Mr. A. Mallock before the Institution of Naval Architects on Friday, April 14th. The following is an abstract :—

A considerable number of papers relating to the vibration of ships have been read before this Institution, and in them methods have been given for designing engines which shall be properly balanced. No doubt to have each engine properly balanced is the right and most desirable thing, if it can be done without interfering with its working in other respects.

Thus, in twin-screw ships, no matter how much the engines individually are out of balance, freedom from vibration in the ship can be secured if the engines are constrained to run at the same speed and in opposite phase to one another. Reports on such subjects often referred to the complete absence of vibration in twin-screw vessels, when the phases of the engines are opposed, as an illustration of the fact that properly applied balance weights would prevent vibration altogether, for in this case the moving parts of each engine act as balance weights to the other, and if any method could be found of keeping the relative phase of the two engines constant, no other balancing would be required.

Of course, it is impracticable to connect the engines by gearing or any equivalent mechanical device. Any connection between the two engines, if the method is to be a practical success must be applicable at will and capable of being removed with ease without

stopping the engines or interfering in any way with their separate working when removed.

A NEW FORM OF GOVERNOR DESCRIBED.

All this might be done with a governor of the form suggested diagrammatically in figs. 5 and 6, A and B and C, C' are a set of differential wheels of which A is driven by the port, and B by the starboard engine. The axes of the intermediate wheels C, C' are fixed to the shaft E, which carries the eccentric F from which the valve G is worked. As long as A and B revolve at the same speed the shaft E remains stationary, but it rotates if the speeds of A and B differ.

The valve at G is made so that if the shaft E, with its eccentric F, moves in either direction from some assigned position, owing to a difference of speed between A and B, high-pressure steam is admitted to the low-pressure cylinder of the engine which has the lesser speed until the valve and eccentric resume their original positions. The steam pipes required for this purpose would be very small. By cutting off the steam supply to G the governor would cease to operate, and the engines would then be absolutely independent.

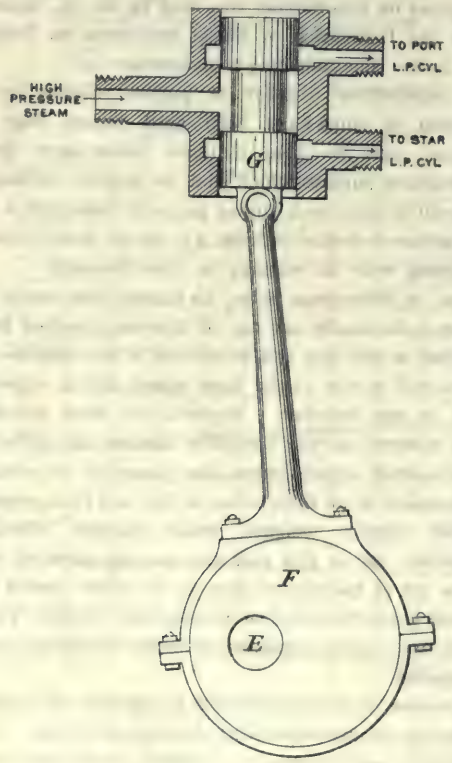


FIG. 6. ANOTHER VIEW OF GOVERNOR SHOWN IN FIG. 5.

VARIATION OF ANGULAR VELOCITY IN SHAFTING OF MARINE ENGINES.

Mr. John H. Heck read a paper on this subject, of which the following is an abstract:—

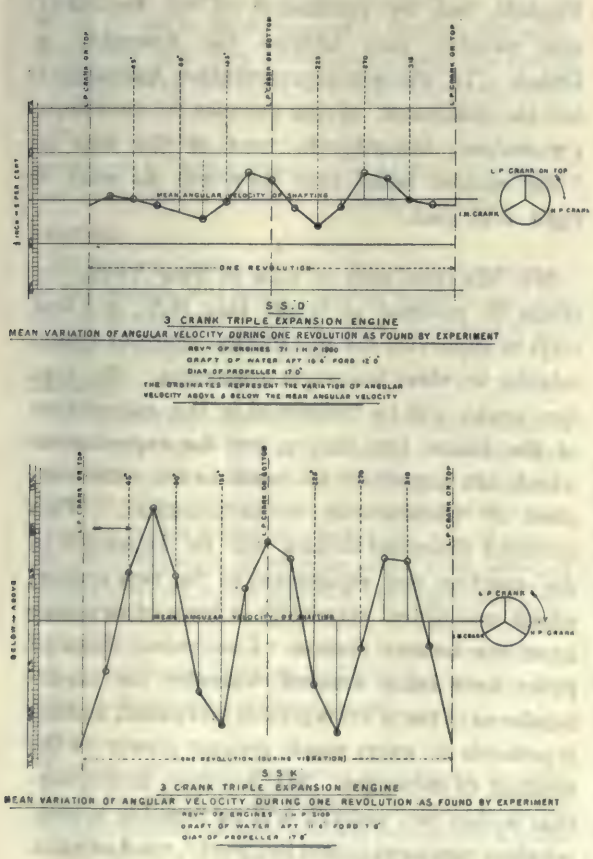
In many of the investigations on the balancing of engines which have appeared from time to time in papers read before this and kindred institutions, it has often been assumed that the angular velocity of the shafting was uniform or nearly constant. As a difference of opinion appeared to exist as to whether this assumption was sound or not, it was decided to make some tests. Many experiments having been made under different conditions to determine the variation of angular velocity in the shafting of marine engines, it was thought that some of the results would be of interest.

It is, of course, well known that two-crank compound engines when at sea are more subject to heavy racing than three-crank triple-expansion engines, and there are many engineers who have had experience with all types of engines who claim that four-crank quadruple engines are still less liable to racing, and therefore make quicker voyages. The variation of velocity in the shafting was found to diminish as the draught of the vessel increased. Figs. 7 and 8 illustrate curves taken from similar vessels of large size fitted with duplicate engines, the only difference on the trials being a variation in the draught of water. At low speeds of revolution the variation in the angular velocity per revolution was nearly always greatest, and, as the revolutions increased in number, the variation became less; when an exception to this rule took place, vibration became apparent; when the vibration increased, the variation in the angular velocity increased, and when the vibration became excessive, the variation in the velocity of the shafting became considerable; the engines at certain intervals of the revolution going slower; at other intervals faster. In fact, there was a regular cycle in the variation of the velocity; the ship, when vibrating, appeared to act as a powerful brake on the engines, which was applied hard at some intervals of the revolution and released at others.

The brake, or retarding effect which becomes apparent when the engines or the structure to which they are attached begin to vibrate, appears to account, amongst other things, for the opinion which is sometimes put forward, that engines attached to a heavy and strong foundation always run smoother and are more economical than similar engines working under apparently equal conditions, but attached to foundations of a less substantial character.

SUBMARINE SIGNALLING.

Mr. J. B. Millet read a paper on "Submarine Signalling by Means of Sound." He said that it was found that the "tank" with an immersed microphone was the key to the whole situation, both for the reception of submarine sounds on board ship and the transmission of them from a ship through the water to an observer outside. In the meantime, repeated tests with bells in the open ocean had proved that a bell with a lip, or "sound bowl," several inches thick, and having a high musical note, gave the best carrying note in the water, although such a bell was quite unsatisfactory in the air. The hammer was actuated by electric magnets contained in a watertight chamber, the whole design to be submerged at any depth and operated by cable from a power house on shore. A bell weighing 1,000 lb. was kept in operation in an exposed position on the Atlantic coast for one year, with entire success, at a depth of 60 ft. from the sea surface and 50 ft. above the floor of the ocean on the end of a cable 1,500 ft. in length. The present type of bells gave such entire satisfaction



FIGS. 7 AND 8.

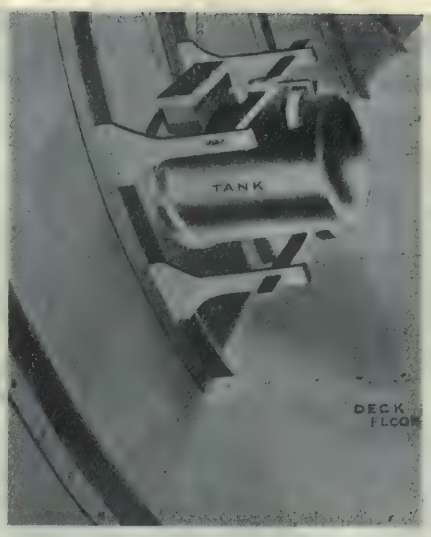


FIG. 9. SHOWING TANK IN POSITION.

that further experiments had been stopped. The large number of overtones in an ordinary bell which gave it the desired musical quality were not wanted, apparently, in a submarine bell, and were not found in the new form. The power used might be steam, compressed air, electricity, or hydraulic. In the case of compressed air or electricity, the mechanism for ringing the bell was placed directly over and attached to it, which ensured its operation in whatever position it might be made to assume by tides or currents. The Submarine Signal Company determined to build and operate for a long period the three kinds of stations into which air signals were naturally divided, namely, a lighthouse station, which necessitated a cable; a bell buoy, in which the submarine bell was to be rung by wave motion; and a lightship, where steam or compressed air furnished the power with the bell hung over the side at some depth just below the keel. A regular working system was established between New York and Boston. In order to thrash out the menacing problems of "ships' noises," arrangements were made to instal the hearing apparatus (transmitters and receivers) on a line of steamers running between New York and Boston. Permission was obtained from the U.S. Lighthouse Board to place submarine bells on four of the lightships on the course of these steamers, all expenses to be borne by the Signal Company. These bells were accordingly installed, and it was found that if the tanks (fig. 9) were placed below the water-line at certain fixed points aft, and at certain fixed points above the keel, if they were filled with a solution

FIG. 10. FORM OF BELL USED IN SUBMARINE SIGNALLING.

denser than sea water, and it the transmitters were adapted to the recognition of sounds of high pitch and not those of low vibration, the submarine bell notes and other sounds like screws of steamers were readily heard.

Ferro-Concrete Goods Station.

A goods station upon a colossal scale is being erected by the North-Eastern Railway Company, at New Bridge Street, Newcastle. When completed the great warehouse will be the largest single building in Newcastle. Some sense of its size may be gained when it is stated that there will be space on the floors for six trains abreast, with, of course, the platforms. The warehouse will be built throughout of ferro-concrete, on the Hennebique system. The floors and other parts of the structure have been subjected to severe tests. Two beams, of 28 ft. and 35 ft. span respectively, were loaded with 205 and 257 tons, and the deflection did not exceed three-eights of an inch.

NEWS ITEMS.

It is hoped that the new Constitution given to the Transvaal will do much to ensure the continuance of the era of prosperity which already seems to have set in at the goldfields. The Constitution provides for a Legislative Assembly, consisting of the Lieutenant-Governor, between six and nine official members, and between thirty and thirty-five elected members. Every burgher of the late Republic entitled to vote for the First Volksraad, and any white British subject occupying premises of the annual value of £10, or capital value of £100, or earning £100 a year, will be entitled to vote. A Commission is to be appointed to create from thirty to thirty-five electoral districts upon the principle of an equal number of voters. All debates are to be carried on in English, but, by permission of the President, any member may address the Assembly in Dutch. To the new representative Assembly is left the fulfilment of the promise to contribute £30,000,000 towards the cost of the war in "the assured belief that they will do what is right and just."

Mr. Marconi, who is now in New York, intends to proceed to Glace Bay, N.S., in a few days to supervise the installation there of trans-atlantic wireless telegraph apparatus. He says five weeks will be consumed in the completion of the Glace Bay station, and the experiments which are expected to result in the establishment of transoceanic communication. Two hundred thousand dollars will be expended in the erection and equipment of the new station, which will differ materially in form of structure from the former station. Concentric rings of poles have been erected whereby the superficial area of the wires is greatly increased, making it possible to exert much greater power in the sending of messages. Mr. Marconi anticipates that within two years, it will be possible to send wireless messages round the world, via Australia.

OPENINGS FOR TRADE ABROAD.

Switzerland.

The number of water-power installations for the production of electric power in this country is increasing considerably. An unusually large installation of this nature is about to be erected in the Canton of Schwytz where it is proposed to dam the river Sihl, thus forming an artificial lake in a valley. The superficial area of the lake will be 11·6 kilom., with a capacity of 96,500,000 cubic metres of water. The dam will be 26 metres high and nearly 100 metres long. The horse-power produced will be 28,000 for 24 hours or 60,000 for 11 hours. An agreement as to this undertaking has been signed on behalf of the Cantons of Schwytz and Zurich, and it is hoped that the operations will be started directly.

France.

The Managing Director of the Pont-à-Mousson Iron Foundry has presented a statement to the French Academy of Science, as to the discovery on the 19th March, of coal in the department of Meurthe-et-Moselle. Researches have been carried on for some time past in this department, and at the present time fourteen borings for coal are in course of progress. The coal discovered at Pont-à-Mousson is very near the surface and, in the opinion of M. Zeiller, Professor at the School of Mines, is of the same class as that in the Saarbruck Mines.

Belgium.

Tenders are invited by the "Bourse de Commerce" for the supply of a weighbridge for locomotives. The date of adjudication is not yet fixed. A deposit of £40 is required to qualify any tender.

Ecuador.

The Ecuadorian Legation in New York have announced that their Government have decided to construct a railway from Ambato to the Curarey River, a distance of about 100 miles. The railway will enable that district to export its rubber and other products by way of Guayaquil. It is expected to have the entire route surveyed within a year, by which time the Guayaquil and Quito Railway will have been completed to Ambato, the initial point of the new line. The route lies almost entirely east of the Andes, Ambato being in the heart of that range, at an elevation of about 7,000 ft.

Spain.

Tenders, which will be opened at noon on the 10th July, at the offices of the Secretary to the Port Works Board, Santander, are invited for the provision of a steam dredger, at the maximum cost of about £8,506.

Portugal.

Tenders will be opened on the 9th May at the Directorate-General of Public Works and Mines, Lisbon, for the construction of a bridge, with metallic platform, over the road from Mertola to Villa Real de Santo Antonio, in accordance with plans on view at the above-mentioned office. A deposit of about £83 is required to qualify any tender. Local representation is necessary.

Italy.

The Municipality of Pallanza have decided on the construction of an electric tramway from that city to Fondotore, in order to connect Pallanza and the valley of Ticino with the Simplon line.

British India.

The Great Indian Peninsula Railway Company invite tenders for the supply of the following stores: Locks, etc.; pig iron; fire-bricks and clay; railway tickets, etc.; Sheffield tools, etc.; Portland cement; lamps and lamp fittings; wrought-iron hinges; wrought iron; lamp wicks; steel tyres; bellows and forges. Specifications and forms of tender may be obtained at the Company's offices, 48, Copthall Avenue, E.C., on payment of the fee for the specification, which payment will not be returned. Tenders must be delivered in sealed envelopes, addressed to the Secretary, marked "Tender for Locks, etc.," or, as the case may be, not later than 11 a.m. on Thursday, the 4th May.

Germany.

The Bavarian Minister of Ways of Communication is considering a project for instituting electric traction on the main lines of Bavaria. It is proposed to utilise for this purpose the vast amount of water power which exists in the Bavarian Alps. It is said that, among others, the line from Munich to Lindau (a distance of 220 kilometres) will be transformed.

Montenegro.

We understand that the Commercial Bank of Milan has expressed its willingness to advance a loan of £128,000 to the Government of Montenegro, for the construction of a port at Antivari and the laying down of a narrow-gauge railway between that town and Virpazar on Lake Scutari. The execution of these works will be put in hand without delay, and may possibly be completed in two years.

NAVAL NOTES.

A SUMMARY OF PROGRESS IN CONSTRUCTION AND ARMAMENT.

THE annual return asked for by Sir Charles Dilke, showing the fleets of Great Britain, France, Russia, Germany, Italy, United States and Japan, has been published, corrected to March 31st last, but a number of vessels are included in the return which have been disposed of by sale, or removed from the effective list as inefficient. The return is prefaced by the accompanying comparative numerical statement, an extract from which was given last week.

BUILT.

	G. Britain.	France.	Russia. ¶	Germany.	Italy.	U. States.	Japan.
Battleships, 1st class ..	53	20	14	16	14	12	5
,, 2nd class ..	4	9	4	4	—	1	1
,, 3rd class ..	2	1	1	9	2	—	—
Coast defence vessels, arm'd	1	13	12	11	—	11	1
Cruisers, armoured	24	17	6	4	6	6	8
Cruisers, protected :							
1st class	21	7	5	1	—	3	—
2nd class	45	16	*3	8	5	17	11
3rd class	*21	16	2	16	†13	2	7
Cruisers, unprotected ..	—	1	3	17	1	7	8
Torpedo vessels	21	‡15	7	1	11	—	1
Torpedo-boat destroyers .	128	31	40	37	13	20	21
Torpedo boats	91	238	162	84	128	31	84
Submarines	17	39	13	§1	1	8	—
	428	421	272	209	194	118	147

BUILDING.

Battleships, 1st class ..	8	6	5	6	4	12	2
To be laid down 1905–6 ..	1	—	3	2	—	1	—
Cruisers, armoured	15	6	2	3	1	7	—
To be laid down 1905–6 ..	4	2	4	1	3	2	—
Cruisers, protected :							
1st class	—	—	2	—	—	—	—
2nd class	1	—	—	—	—	—	—
3rd class	—	—	—	4	—	—	—
To be laid down 1905–6 .	—	—	—	3	—	—	—
Scouts	8	—	—	—	—	—	—
To be laid down 1905–6 ..	—	—	—	—	—	3	—
Torpedo-boat destroyers ..	16	8	55	6	—	—	—
To be laid down 1905–6 .	18	4	8	6	4	—	—
Torpedo-boats	—	26	10	—	27	1	—
To be laid down 1905–6 ..	—	70	—	—	—	—	—
Submarines	12	9	12	§1	5	—	—
To be laid down 1905–6 ..	11	23	2	—	2	4	—
	94	154	103	32	46	30	2

* Including one partially protected.

† Including two partially protected.

‡ Including one torpedo depot ship.

§ Experimental.

¶ 1st class battleships; one interned. Cruisers, protected, 1st class; two interned, one reported disabled. Torpedo-boat destroyers: ten interned.]

The work of "fortifying" the interior of the battleship *Hibernia* to resist the strains incidental to the launching of the vessel has been rapidly advanced. It is announced that the battleship *Africa* will take the water on May 20th, and that the naming ceremony will be performed by the Marchioness of Salisbury.

UNITED STATES.

The plans for the new battleships *Carolina* and *Michigan* are being prepared and it is stated that the principal characteristics will be triple screws and main batteries composed of only twelve and ten-inch guns, and there is even a prospect of a new gun of about 11-in. calibre being evolved. Some of the United States cruisers have been fitted with triple screws, but hitherto the system has not been applied to battleships, although it is stated that a low speed is maintained more economically than with twin screws, and that the size of the engines can be reduced.

The coal consumption of the armoured cruiser *Maryland* which has been on trial has proved to be so large that although her speed of 22·406 knots attained with a horse-power of 27,571, is held to be very satisfactory, it is believed some changes will have to be made before she enters into service.

Two new turbine cruisers or scouts will be built by the Fore River Company, and one vessel, a sister ship fitted with reciprocating machinery, will be built by the Bath Ironworks Company. These vessels are to have a speed of 24 knots, and the Fore River Company's tender was the lowest sent in, totalling $1,468,000 each for turbine vessels, and $1,689,000 for vessels with reciprocating engines. It is not stated what was the Bath Ironworks Company's tender.

AUSTRO-HUNGARY.

The battleship *Erzherzog Ferdinand Max*, which has been built to replace the old vessel *Novara* will be launched during next month. The *Ferdinand Max* is of 10,600 tons displacement, and a sister ship to the *Erzherzog Friedrich* and *Erzherzog Karl*, which are already completing.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Bournemouth.—The Town Council invite tenders for the following: (Contract No. 5) Feeder cables, troughing, excavation, &c. Mr. F. W. Lacey, M.I.C.E., Municipal Offices, Bournemouth ... ... Last Day. April 29

Bristol.—Construction, delivery, erecting in place, fitting, testing, and maintenance for twelve months after completion, of two electric goods lifts and one electric passenger lift, to be erected in the tobacco warehouse now in course of construction near Cumberland Basin, Bristol, for the Dock Committee. Mr. N. W. Squire, Engineer, Cumberland Basin, Bristol ... May 1

Coalville. — The Urban District Council (Gas Department) invite tenders for the supply of a steel gasholder and tank and its erection at the Gas Office, Whitwick. Mr. Jos. W. Eagles, Gas Office, Whitwick. May 1

Shrewsbury.—Tenders for taking down the old cast-iron bridge at Buildwas, and for the supply and erection in its place of a steel curved girder bridge. Mr. A. T. Davis, M.Inst.C.E., County Surveyor, Shirehall, Shrewsbury ... ... May 3

Birkenhead.—Supply and erection of cast-iron purifiers, connections, centre valve, superstructure and roof, and oxide elevator and conveyor at their gasworks, Thomas Street, for the Corporation. The site of the works and drawings may be inspected upon application to the engineer, Mr. T. O. Patterson, at the gasworks ... ... May 4

Southampton. — Supply of about 250 tons of 7-in. girder rails and reconstruction of tramways, Portswood-road, for the Corporation, in accordance with specifications and conditions, which may be obtained on and after to-day of Mr. H. F. Street, borough electrical engineer and tramways manager ... May 5

Bishop's Stortford.—Carrying out of the following works at their sewage pumping station, for the Bishop's Stortford Urban District Council: (Contract No. 1) For supplying and fixing two Lancashire boilers, 18 ft. long by 6 ft. 6 in. diameter; (2) for supplying and fixing steam pumping engine and pumps. Mr. Thos. Swathebridge, 7, North Street, Bishop's Stortford ... ... May 8

Edinburgh.—Supply and erection of water-tube boilers at the M'Donald Road electricity works. Town Clerk, Mr. Thomas Hunter, City Chambers, Edinburgh ... May 8

Huddersfield.—Supply and erection of ash-elevating plant and storage tank, also slack-elevating and conveying arrangements for feeding eleven Lancashire boilers, and for excavation and masons' work. Mr. A. B. Mountain, St. Andrew's Road, Huddersfield ... ... Last Day. May 8

Aberystwyth.—For carrying out the proposed works of water supply for Bow Street, for the Aberystwyth Rural District Council. Mr. Richard Jones, Penrhiw, Bow Street, Aberystwyth ... ... May 8

Banbridge (Ireland).—Erection of a covered-in steel footbridge at Banbridge Station, for the Great Northern Railway Company (Ireland). Mr. W. H. Mills, engineer-in-chief, Amiens Street Terminus, Dublin .. .. May 9

Manchester.—Supply of oil for the manufacture of carburetted water gas for the Gas Committee. The oil to have a flashing point of not less than 73 degrees. Mr. Charles Nickson, Superintendent of the Gas Department ... ... May 10

Barrow-in-Furness.—Construction of a steel road bridge over the Walney Channel, uniting Barrow Island and Walney Island. The bridge will be about 1,123 ft. in total length between abutments and 50 ft. in length, and will consist of eight fixed girder-spans, and one opening span, on cylinder foundations. Sir Benjamin Baker, K.C.B., 2, Queen Square Place, Queen Anne's Mansions, Westminster ... ... May 15

Irvine.—Supply and erection of (1) buildings; (2) power-house plant (suction-gas plant, gas engines and generators, balancers and boosters, battery of accumulators, switch-board and crane); (3) mains (cable trenches, etc., converting street lamps, meters). Messrs. Kirkland and Capper, 17, Victoria Street, Westminster, London, S.W. ... ... May 15

London.—Supply and erection at its generating station (East Greenwich, S.E.) and maintenance for ten years, of a battery of 280 accumulator cells having capacities of 645 ampere hours at a three-hour discharge rate and of 450 ampere hours at a one-hour discharge rate. Specifications, etc., at the County Hall, Spring Gardens, S.W. May 16

Erith.—Dredging in the River Thames, in front of the Crossness outfall works, in the parish of Erith, in the county of Kent, for the London County Council. Chief engineer, Mr. Maurice Fitzmaurice, C.M.G., County Hall, Spring Gardens, S.W. ... ... May 16

Hartlepool. — Construction of a self-propelling barge-loading dredger, capable of lifting 600 tons per hour and of dredging to a depth of 40 ft. below water level; also for the construction of a twin-screw steam hopper barge (hopper capacity 500 tons, speed nine knots loaded), for the Hartlepool Port and Harbour Commission. Mr. J. D. Howkins, engineer, Hartlepool ... ... June 15

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... Sep. 1

COMING CONTRACTS.

St. Just.—Messrs. Merryweather and Sons, of London, have received instructions from the St. Just Urban District Council to prepare plans for a water supply to Boscaswell and Higher Trewellard, for submission to the Local Government Board.

Dunfermline.—In a report referring to an electric supply scheme for the town, Mr. W. B. Sayers recommends the erection of a combined refuse destructor and electric supply works.

Louth.—An electric supply scheme, estimated to cost £13,010 has been approved. The plant will include two Hornsby oil engines, two 75-kw. dynamos, balancer and booster, switchboard, storage battery.

Bexhill-on-Sea.—An inquiry has been held into Corporation's application for sanction to borrow £6,000 for electric supply purposes.

Burnley.—The Corporation has decided to get a 500-kw. steam generator, etc. to cost, with switchboard extensions and so forth, £6,105.

Falmouth.—Plans for an electric supply scheme are being prepared.

Kirkintilloch.—The Town Council has adopted an electric supply scheme, estimated to cost £2,250.

CONTRACTS CLOSED.

Norway.—In connection with the new works of the Dunderland Iron Ore Company, Ltd., Norway, contracts have been recently placed with the Chain Belt Engineering Company, Derby.

India.—The Vulcan Foundry, Ltd., of Newton-le-Willows, Lancashire, have received an order for an additional 30 standard-type goods locomotives for the Indian State Railways.

Great Western Railway.—The Great Western Railway Company have placed an order with the Kennicott Water Softener Company for a water softener capable of dealing with 30,000 gallons of water per hour. This softener is to be placed on their line at Severn Tunnel Junction.

Montreal.—Hathorn, Davey and Company, Ltd., of Leeds, have secured the contract to supply a 12 million gallon steam pumping engine to the Montreal Water Works for the sum of $53,497.

Greenwich.—The tender of the Western Electric Company at £2,232 4s. 9d. was accepted for low-tension cables for Greenwich. The tender of Conduits and Fittings (Ltd.) at £1,407 was accepted for general wiring material.

Portsmouth.—The Town Council have accepted the tender of the International Electric Company for extension of the telephone switchboard at the municipal exchange at £1,327 10s.

Dundee.—In connection with the Dundee-Broughty Ferry Tramway power station the contract for three Lancashire boilers has been let to Carmichael and Co., Dundee.

APPOINTMENTS VACANT.

Last Day.

Hull.—A lecturer on electrical engineering is required at the Municipal Technical School. Commencing salary £160. Dr. J. T. Riley ... ... May 4

Southend-on-Sea.—Borough Electrical engineer and general manager of the tramways. Commencing salary £400, rising by annual increments of £25 to £500 per annum. Town Clerk, Mr. W. H. Snow ... ... May 8

London.—Two additional assistants in the department of electrical engineering of the City and Guilds Central Technical College, Exhibition Road, London, S.W., to give instruction in electric machine drawing and construction and electric machine testing. Salary £150 per annum. Applications to Professor Ayrton ... ... —

APPOINTMENTS FILLED.

Leeds.—Mr. George Adam Hart, chief assistant engineer to the Birmingham Tame and Rea Drainage Board, has been recommended by the Sewerage Committee of the Leeds Corporation for appointment as sewerage engineer at a salary of £1,000 per annum.

Bloemfontein.—Mr. John Riley, of Cape Town, has been appointed chief assistant in the office of the city engineer of Bloemfontein, at a salary of £400 a year.

Hove.—The Town Council have appointed Mr. G. M. Harris (who has acted as electrical clerk of works under the consulting engineers, Messrs. Handcock and Dykes, at Aldrington) as resident electrical engineer.

North-Eastern Railway.—The directors of the North-Eastern Railway at their recent meeting appointed Mr. Philip Burtt deputy-general manager of the company. Mr. Burtt has, since December, 1900, occupied the position of general traffic manager of the railway.

Ossett.—The Town Council has appointed Mr. Walter Emmott, of Halifax, as engineer of the electricity undertaking which is about to be installed.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows :—
Consols : May 4th, June 1st. General Settlements : April 28th, May 12th, 31st. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅜ — 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4⅜ — 4⅞
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 5/16 — 3 7/16
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅛ — 5⅜
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 — 104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4⅜	Babcock and Wilcox, Ltd., Ord.	1	4⅞ — 5⅛
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1 1/16 — 1 1/8*
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4⅜ — 5½
250,000	1	6⅜d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —105
150,000	4½	2/8⅜	Barrow Hæmatite Steel Co., Ld., O.	4½	1 5/16 — 1 7/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛ — 4⅜*
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104 —106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7/16 — 7/16
300,000	1	6⅜d.	Do. 5½% Cum Pref.	1	3/8 — 5/8
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	15/16 —
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	½ — 9/16
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16 — 1 5/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1 3/16 — 1 5/16
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11½ — 11¾
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord.	5	8¾ — 9
232,500	5	2/6	Do. 5% Cum. Pref.	5	5 5/16 — 5 5/16
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	1 3/16 — 1 5/16
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅜
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 —103
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	32— 33
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	16 —16¼
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—12
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd.	1	3/8 — 1/2
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3⅜ — 3⅝
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord.	1	7/8 — 1
300,000	1	7½d.	Do. 6% Cum. Pref.	1	5/8 — 7/8
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½ — 10½
69,754	13	12/-	Do. do. do.	10	7½ — 8
20,250	10	8/-	Elliott's Metal, Ltd.	3	4½ — 5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾ — 9¼
186,748	Stk	4%	Do. Deb. 4%	100	94½ — 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11 — 11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000	10	12 —12¼*
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	4⅜ — 4⅞
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾ — 6½
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red.	100	90½—91½
16,800	10	—	Greenwood & Batley, Ltd., Ord.	10	4½ — 4¾
9,600	10	7%	Do. 7% Cum. Pref.	10	10½ — 10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 3/16 — 2 5/16
344,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	106 —108
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3¼ — 3½
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾ — 11½
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1¼ — 1⅜
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	10¾ — 11
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	5 — 5½
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	1¼ — 1⅜
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾ — 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½ — 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	1⅜ — 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
37,500	10	20	Kynoch, Ltd.	10	18¾— 19½
49,537	10	5%	Do. Cum. Pref. 5%	10	10¾— 11
300,000	1	4½d.	Lambert Bros., Ltd., Ord.	1	3/8 — 5/8
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4¼— 4¾
40,000	3	2/1½	Leeds Forge Co , 7% Cum. Pref.	3	3¾ — 4¼
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 1/8 — 1 1/16
£300,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk., Red.	100	109 —111
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼—11⅝
210,000	1	8⅜d.	Measures Bros., Ltd., Ord.	1	1 1/16 — 1 1/8
75,000	1	6⅜d.	Do. 5½% Cum. Pref.	1	1 1/16 — 1 1/8
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	5¼ — 5½
14,248	5	5%	Do. Pref. 5%	5	4⅛ — 5⅛*
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 —12¼
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3¾ — 4⅛
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	5¾ — 6¼
70,000	10	6/-	Pease & Partners, Ltd., Ord.	10	9¾ — 10¼
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	99 —102
20,000	5	3/-	Peebles(Bruce) & Co.,Ld., 6% Cm.P.	5	4⅛ 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	6/- — 6/
13,000	5	—	Do. 5½% Cum. Pref.	5	4⅜ — 4½
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	3/8 — 1/2
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1¾ — 2
73,062	5	2/-	Do. New	5	1½ — 1⅝
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	101 —103
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	13/16 — 7/8
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	9½ — 10
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	3/4 — 7/8
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 1/16 — 1 1/8
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red	100	93 — 96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	21/32 — 23/32
300,000	1	1/2⅜	Do. 6%Cum. Pref.	1	31/32 — 1 1/32
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	88 — 91
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560	9	5¼— 5⅝
£125,240	Stk	5%	Do. 5% Trust Mort. Deb.	100	106½—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	1½ — 2
25,000	10	5/6	Do. 5½% Cum. Pref.	10	4¼ — 4½
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	78 — 81
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17¾ — 18*
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¼ — 15*
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	3/4 — 7/8
538,845	1	6d.	Do. 5% Cum. Pref.	1	1 — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	5/8 — 3/4*
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	74 — 79*
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	13/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 10
$508495200	$100	8½	United States Steel Corp. Com. Stk.	$100	36⅞ — 37½
$360314100	$100	$1½	Do. 7% Cum. Pref. Stock	$100	104½ —105½
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	98 —100*
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord.	1	2⅜ — 2½
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1 3/16 — 1 5/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	118 —121
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	107 —109
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 —108
225,000	1	1/2⅜	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16 — 15/16
500,000	1	7½d.	Do. 6% Cum. Pref. Ord.	1	7/8 — 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	84 — 88
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4⅜ — 4⅞
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/-	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2 — 3
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 — 86

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	⅞— ⅞
120,000	1	1/2½	Bell's Asbestos Co., Ltd.	1	1⅛— 1¼
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½— 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½— 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red..	100	99 —101
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 7% Pref..	5	2⅞— 3⅛
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	91 — 93
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½— ¾
150,000	2	2/4½	Do. 6% Pref.	2	1½— 2
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 11½
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5¼— 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107 —109
85,000	3	1/6	Crompton & Co., Ltd...	3	2 — 2¼
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95—100
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7⅜— 8¼
[61,000	5	3/-	Do. 6% Cum. Pref.	5	5⅜— 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
283,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	5	1 — 1¼
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1¾— 2¼
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	80 — 85
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	84— 89
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1 — 1½
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	2¼— 2⅜
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd.	10	11 — 13*
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½— 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11 —12
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½— 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 — 38
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 —105

III.—ELECTRIC TRACTION.

Present Amount ubscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅞— 8⅞*
260,007	5	2/6	Do. 5% Cum Pf.	5	5½— 6
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	12 — 12½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 —102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅛— ⅛
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	1 — 1⅛
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾— 4¼
£425.000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	104 —107
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9½— 9⅝
156,437	10	6/-	Do. 6% Cum. Pref.	10	10⅜— 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	120 —122
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	98 —100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½— 3⅝*
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5 15/16— 5 17/18*
27,000	5	3/-	Do. "B" do.	5	5¼— 5⅜*

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97 — 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 —105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	8½— 8¾*
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1½— 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅜— 5*
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102*
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	103 —105
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½— 14½
59,987	10	6/-	Do. 6% Pref...	10	15½— 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2⅝— 3½
			Do. 4% Deb. Stock.. ..	100	85 — 90
£150,000	Stk	4%	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10¾—10¾
125.000	10	5/-	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—103
£1,031,000	Stk	4%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 —103
£50,000	Stk	5%	Metropolitan Elec. Trams, Ltd., Def.	1	⅛— ⅛
314,016	1	—	Do. 5% Cum. Pref... ..	1	1 — 1⅛
500,000	1	6d.	Do. 4½% Deb. Stock, Red.	100	105 —107
£350,000	Stk	4½%	New General Traction Co., Ltd., 6% Cum. Pref.	5	⅜— 1½
50,000	5	6/-	North Metropolitan Tramways Co..	8	4 — 4½
110,923	8	3/2⅝	Do. 3½% Mort. Debs.	100	90 — 95
£150,000	100	3½%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	105 —108
£196,200	Stk	5%	Potteries Elec. Traction Co., Ld., Or.	10	9 —9¼*
24,500	10	10/-	Do. 5% Cum. Pref. ..	10	9½— 10
24,500	10	5/-	Do. 4½% Deb. Stk., Red.	100	103 —107
£220,000	Stk	4½%			

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾— 12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10— 10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106 —108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5⅜— 5⅝*
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103 —106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9¾— 10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9½— 10½
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	7½— 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅜— 5⅝
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105 —107
41.436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6½— 7
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 —111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½— 12
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½— 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 —114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5⅜ - 6
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅜— 6⅝
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
19,000	5	3/6	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 5⅝*
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9¾— 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7½— 8*
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	102—105
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	11/16— 13/16
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12½— 13

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£185,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103
111,000	3	1/9⅜	London Elec. Supply Corp., Ld., Ord.	3	2¼ — 2⅜
60,000	5	3/-	Do. 6% Pref.	5	5¼ — 5⅜
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	17½—18½
76,121	5	2/8	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —114
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk, Red.	100	97 — 99
£250 000	—	4½%	Midland Elec. Corp. for Power Distribut on Ld., 4½% 1st Mort. Deb.	100	99 —101
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½—15½
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼— 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13½—14½
20,000	5	3/6	Do. 7% Pref.	5	8¼— 8⅝
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 9⅛
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	4 — 4½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅝d.	Do. 7% Cum. Pref.	1	1 5/16—1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅛— 5 1/16
30,000	5	2/6	Do. 5% Cum Pref.	5*	5¼— 5½
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2⅜
£763,580	Stk	15/-	Anglo-American Tel. Co.. Ltd., Ord.	100	60 — 62*
£3,118,210	Stk	30/-	Do. 6% Preferred Ordinary	100	106 —107*
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15⅛—15⅝
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅝— 6⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	——
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8½— 9
6,000	10	10/-	Do. 10% Preference .. .	10	16½— 17½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	8½— 9
£30,000	50	4½%	Do. 4½% Debs...	50	101-103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11½—11¾*
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Db.	100	100—102
£200.000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14 — 14½
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£1,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	139 —142*
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	91 — 93*
£1,886,814	Stk	4%	Do. 4% Mort. Deb.	100	108 —110
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	37 — 39
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	52 — 54
72.680	1	7⅛d.	Monte Video Telephone Co., Ltd., O.	1	⅜— ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108½—109½
£1,966 667	Stk	5%	Do. Deferred	100	100 —102
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¼ — 5⅜
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689,593	Stk	4%	Do. 4% do. do. ..	100	103½—105½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1⅛ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 3/16 — 1 5/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 —102
11,889	8	4/-	Reuter's Telegram Co., Ltd. ..	8	8 — 8½
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7½
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5½
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107—109
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	8 — 8½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	1/16 — 1/8
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	1⅛— 1⅜
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½— 8¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8 — 8½
£80,000	100	5%	Do. 5% Deb.	100	103 —105
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13⅜— 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8⅜— 9½
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	100—102
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	97 — 99
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5⅜— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	88 — 92
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	100 —102
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	12 -- 13
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£464,480	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 3/16— 1 5/16
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5⅛*
36,758	8	4/9⅜	Do. Non-Cum. 6% Pref.	8	8 — 8⅛
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2⅜
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3⅛
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	84 — 87
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4½— 5
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	132 —136
£1,160,000	Stk	19%	Do. do. Deferred ..	100	229 —232
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	29 — 30
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4⅜
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8½— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... .	10	10¾— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60 000	1	9⅜d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1— 1⅛
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	130 —135
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	7/16— 7/8
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	7/16— 11/16
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 3/16— 1 5/16
135,000	1	7⅛d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

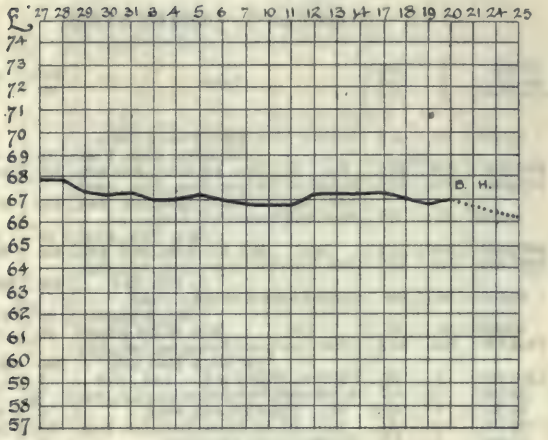
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	22½—23
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¾— 9
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50.000	7	9 — 9½
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4½
14,567	10	1/8	Lancashire Wagon, Ord.	2	2 1/16— 2 3/16
4,150	10	5%	Do. do.	10	10⅜— 10⅝
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/— 43/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/— 25/-
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6— 28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM MARCH 27TH TO APRIL 25TH, 1905.

COPPER.



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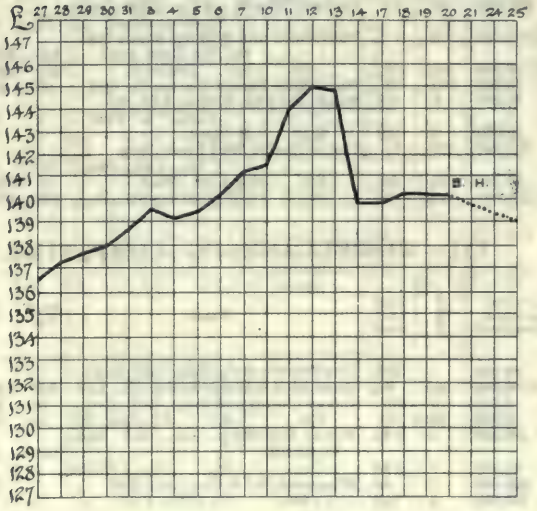

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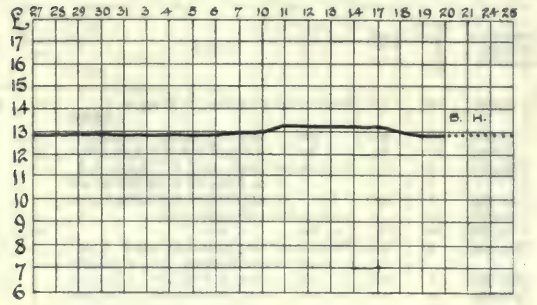

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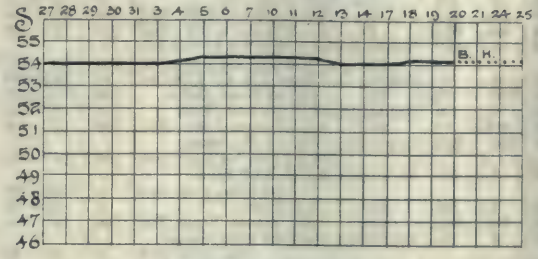

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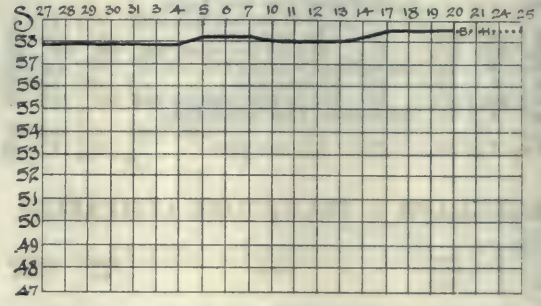
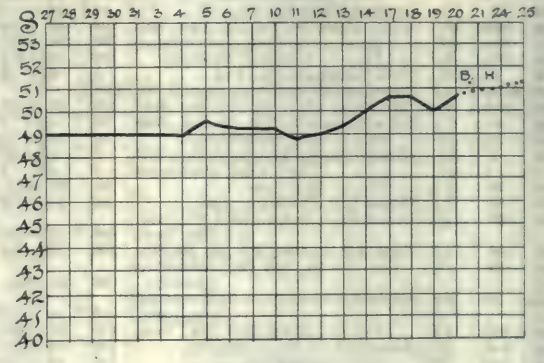
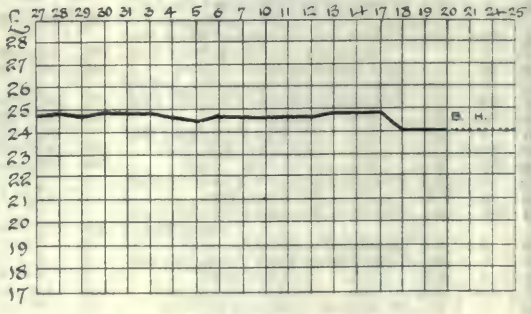


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, April 26th, 1905.

THE copper market has suffered a relapse in sympathy with the decline in Rio Tinto shares, and a good deal of bear selling has been indulged in. The result has been a decline in the quotation for standard copper from £67 10s. to £66 2s. 6d; but appearances point to the fact that the market is oversold, and a sharp recovery, of which however indications are altogether wanting now, may be expected.

The tin market, after the recent phenomenal spurt, has quieted down, cash metal being quoted at £138¼-½, and three months at £134¼. Consumers are, however, apparently somewhat short of stocks, and the quotation looks like going better. Eastern advices have been strong, transactions taking place at over London parity.

Lead has been firmer on Russian purchases, but the higher prices induced realisations on the part of speculative holders on the London market, and some slackening off in the demand from home consumers is also to be noted. The best quotation, therefore, has not been maintained, although the tendency is rather firmer at the close to-day at £12 13s. 9d. foreign, and £12 18s. 9d. English.

Spelter has improved, owing to a better demand for sheet zinc for Continental consumers. Nothing fresh is to be recorded with regard to the home trade, which remains in a quiet condition. The advance in price in Silesia brought about some bear covering for near delivery, and the market is being talked higher. The closing prices are £23 17s. 6d. ordinaries and £24 7s. 6d. specials.

In spite of the interruption caused by the holidays a large and excited business has been transacted on the pig iron markets, and somewhat violent fluctuations in prices have been recorded. These fluctuations are entirely due to the position of the speculative account, bull operators having made strenuous efforts to raise the price of Middlesbrough iron, taking large quantities off the market in order to bring about this result. The sensitive condition of the market was illustrated by the fact that a sharp relapse took place the moment the market was left unsupported. The present high price of No. 3 Cleveland warrants, compared with other classes of pig iron, has rather dislocated trade.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

		£	s.	d.
Steel:				
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates.....	5	17	6
	,, ,, Bars ,, ,, ...	6	7	6
STEEL	,, ,, Angles.....	5	7	6
Manufactured Iron:				
Bars—Dalzell.....		6	2	6
,, Best		6	12	6
,, ,, Horseshoe		6	12	6
,, Angle.....		6	2	6
,, Best Angle		6	12	6
,, Best Best		7	2	6
,, Extra Best		7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow Steel).....	5	7	6	per ton.
Steel Ship Plates (Glasgow Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quote:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best.....	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	—
,, Best Boiler	7 10 0
,, Best Best Boiler	8 0 0
,, Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £ s. d.	No. 3. £ s. d.
Coltness, f.a.s. Glasgow	3 4 6	2 14 0
Gartsherrie ,,	2 19 0	2 14 0
Summerlee ,,	2 19 0	2 14 0
Carnbroe ,,	2 16 6	2 12 6
Langloan ,,	3 4 0	2 15 0
Calder ,,	2 19 0	—
Clyde ,,	2 18 6	2 13 6
Glengarnock, f.o.b. Ardrossan	2 18 0	2 12 6
Eglinton ,, ,,	2 14 6	2 12 6
Dalmellington, ,, Ayr	2 14 6	2 12 6
Shotts ,, Leith	2 19 0	2 14 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron. £ s. d.	Steel. £ s. d.
	Bars	6 10 0	6 15 0
(BNF)	Angles	7 0 0	7 5 0
	Tees	7 10 0	7 15 0
	Hoops	7 0 0	7 10 0
W.I.W	Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d.
Best Coke (Finish)	29 0 0	30 10 0
,, Charcoal (Finish)	31 0 0	32 10 0
Extra ,, ,,	33 0 0	34 10 0

Cotton Can Tin Shee's to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works.

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11 12 6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 5 0	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 12 6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¾ by 14 124s. 110 lb. "BV"	0	12	3
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	10½
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	0

Charcoal Tinplates :

C 20 by 14 112s. 108 lb. "Allaway"	0	12	7½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	14	0	per ton.
Billets	at 3	16	0	,,
Sheet Bars	at 3	18	0	,,

Finished Steel :

Bars	at 5	1	0	per ton.
Angles	at 5	2	0	,,
Tees	at 5	5	0	,,
Joists	at 4	10	0	,,
Fencing Standards	at 5	2	0	,,
Shoeing Bars	at 5	4	0	,,
Tyre Bars	at 5	4	0	,,
Half-Round Bars	at 5	7	6	,,
Heavy Rails	at 5	5	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	138	0	0	to	138	10	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	139	0	0	to	139	10	0	,,
Straits G.M.B., cash Warehouse, Net	143	17	6	to	140	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	134	17	6	to	135	0	0	,,
Australian, Mt. Bischoff, Warehouse, Net	140	5	0	to	140	7	6	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	66	7	6	to	66	8	9	per ton.
Standard G.M.B., 3 months, Warehouse, Net	66	12	6	to	66	13	9	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	0	0	to	70	10	0	,,
English, Best Select, Warehouse Net	71	10	0	to	72	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	81	0	0	to	82	0	0	,,
English Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	1½	to	0	13	1½	per unit
Regulus, Matte and Precipitate, ex ship,	0	13	4½	to	0	13	10½	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	15	0	to	24	0	0	per ton.
Blende of 50 % Net	6	9	6	to	6	12	6	,,
Calamine, Net	6	12	0	to	6	14	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	12	17	6	to	13	0	0	per ton.
Spanish, ex ship, Dis. 2½%	12	13	9	to	12	15	0	,,
Lead Ore of 70 %, Net	6	9	0			—		,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	36	0	0	to	37	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	9	10	0	to	10	10	0	,,
Crude, ex ship, Dis. 2½ %	14	0	0	to	16	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flask.
Italian ,, ,, ,,	7	5	0	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1¼)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:		
Steam.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.		
High Hazel.		
London Brights, 4 to 8 in. cube	10	6
Large Nuts, 2 to 4 in. cube	8	6
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0
Steam.—Top Hard.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	6

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	11	,,
	Tartaric at Manchester	0	0	10½	,,
Acetate of Lime:	Brown at Manchester net	9	10	0	per ton.
	Grey ,,	11	15	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	12	6	,,
Arsenic:	Best White Powdered net	12	5	0	,,
Bleaching Powder,	35% ,,	4	10	0	,,
Borax:	British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:					
Benzole, 50/90 %	,,	0	0	6	per gal.
,, 90%	,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C.	,,	0	0	6	per lb.
,, ,, ,, 39/40° C.	,,	0	0	6½	,,
,, ,, Liquid, 97/99 %	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	1	9	,,
Creosote, ordinary good liquid	,,	0	0	1 7/16	,,
Naphtha, Crude, 20 % at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b.	,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,		0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,		0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b.	,,	0	1	0	,,
Naphthalene, all qualities. Pitch f.a.s. Manchester.	,,	1	9	0	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	19	0	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		21	17	6	,,

Cyanides:	98% minimum f.o.b. net	0	0	7½	per lb.

Lead:	Acetate (Sugar) White, English	27	10	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K.	23	5	0	,,
	,, ,, Grey	21	15	0	,,
	,, ,, Brown at Manchester	16	15	0	,,
	Nitrate	24	0	0	,,
	Litharge, Flake	15	10	0	,,
	,, Powder	16	0	0	,,
	Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
	White ,, ,, Dry ,, ,, ,,	16	15	0	,,

Naphtha (Wood):	Miscible, 60 o.p.	0	2	10	per gal.
	Solvent	0	2	7	,,

Potash:	Bichromate... delivered England	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull	18	10	0	per ton.
	Caustic, 75/80 % ,, ,,	20	15	0	,,
	Chlorate net	0	0	3 1/16	per lb.
	Montreal in Store, Liverpool	35	0	0	per ton.
	Prussiate, Yellow net	0	0	5	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined... ... ,,	6	5	0	,,
	,, Carbonated, 48 %..... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % ..... net	6	10	0	,,
	Caustic, White, 77 % ..... ,,	10	10	0	,,
	,, ,, 70 % ..... ,,	9	12	6	,,
	,, ,, 60 % .. .. ,,	8	12	6	,,
	,, Cream, 60 % .... ,,	8	10	0	,,
	Crystals, in bags	8	0	0	,,
	,, barrels	8	7	6	,,
	Acetate ..... c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs.....	6	15	0	,,
	Bichromate.....delivered England...	0	0	2¼	per lb.
	Chlorate .... net	0	0	3 1/16	per lb.
	Nitrate...ex quay Liverpool, ... ,,	11	5	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts).....	1	12	6	,,
	,, (Saltcake, 95%).....	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers.....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	7	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports.....	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre:	French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).....c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	1½	to	0	13	1½	per unit.
Regulus, 45 to 55%	0	13	4⅛	to	0	13	10½	,,
Precipitate, 65 to 80% ...	0	13	7½	to	0	14	1½	,,
Tin Ores, 70 %.....	86	0	0	to	88	0	0	per ton.
Lead Ore, 70%					6	5	0	,,
Blende, 50%					6	9	6	,,
Calamine.....					6	12	0	,,
Antimony Ore, 50%.. ...	7	10	0	to	8	10	0	,,

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...f.o.b.	Porman		6	4	per ton.
Do. ..... ,,	Cartagena		6	7	,,
Special low phos, ,,	Porman		7	0	,,
Do. do. ,,	Cartagena.....		7	3	,,
Extra quality do. ,,	,, ...		7	8	,,
Special Iron Ore ,,	,, ...		8	4	,,
Specular 58% do, ,,	,, ...		9	4	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	7	5	0		7	15	0
Nova Scotia Spruce..	,,	7	0	0		7	10	0
Spruce Boards.....	,,	5	15	0		6	5	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.....	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish.....	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.....	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics.*

6130. H. Jansson, London. March 23rd.—Improvements in turbines. (Date applied for, March 24th, 1904.)

6149. J. Hindmarsh, London. March 23rd.—Improvements in or relating to screws, nails, and the like.

6152. H. Booth, Sheffield. March 23rd.—Improvements in drill cramps for drilling the flanges of tramway rails *in situ.*

6153. P. Epperson, and A. E. Chamberlain, Kingston-on-Thames. March 23rd.—Improvements in railway rails.

6156. T. Cloke, and C. A. R. Hutton London. March 23rd.—Improved steam turbine and machinery, and method of operating same for motors, trollies, vans, and other vehicles.

6157. T. Cloke, and C. A. R. Hutton, London. March 23rd.—Improved system of oil-feed burners and tanks for generating steam.

6195. W. Downie, London. March 23rd.—Improvements in retarders for the fire-tubes of boilers.

6214. K. M. Alley, Glasgow. March 24th—Improvements in and relating to steam gear.

6221. L. Glover, Leeds. March 24th.—An improvement in or in connection with steam generators.

6236. C. C. Riotte, Birmingham. March 24th.—Improvements in multiple cylinder gas engines.

6237. F. A. Lewis, London. March 24th.—Improvements in the prevention of steam boiler smoke.

6301. H. Lentz, London. March 24th—Improvements in and relating to fluid pressure turbines.

6302. R. R. Douglas, London. March 24th.—Improvements relating to the bucket links, elevator links, and connecting links of bucket dredging machinery.

6303. H. Park, and H. Robert Butterworth, London. March 24th.—Improved dredge bucket.

6308. J. W. Jemmison, Preston. March 25th.—Internal combustion engine with rotating piston.

6314. W. Rowbotham, and I. M. C. J. de Havilland, Birmingham. March 25th.—Method of and means for generating power.

6354. N. Balint, London. March 25th.—Improvements in or relating to steam generators.

6365. J. Gray, London. March 25th.—Improvements relating to slide valves.

6367. R. H. Crook, London. March 25th.—Means for utilising tidal energy for operating machinery.

6756. A. L. Miéville, London. March 30th.—Improvements in pumps.

6758. T. Sugden, London. March 30th.—Improvements relating to steam superheaters.

6770. T. Sugden, London. March 30th.—Improvements relating to superheaters connected with steam generators.

6779. F. A. Ford and K. L. Karch, London. March 30th.—Improvements in and connected with machines for drilling angular holes.

6789. S. Brotherhood and C. W. Bryant, London. March 30th.—Improvements in fluid pressure engines.

6793. D. Wood, Gloucester. March 31st.—A water spray for the use of steam road rollers.

6800. The Wolseley Tool and Motor Car Co., Ltd., and A. Remington, Wolverhampton. March 31st.—Improvements in or relating to self-acting induction valves for internal combustion engines, and generally for use with elastic fluids.

6811. A. Bolton, Manchester. March 31st. Improvements in apparatus for superheating steam.

6821. W. Foden and the United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, Ltd., Liverpool. March 31st.—Improvements in or relating to metallic packing for stuffing boxes, and the like.

6836. G. A. Brittain and G. Crawford, Belfast. March 31st.—An improved explosive engine.

6889. A. L. Forster and R. A. Norton, Newcastle. March 31st.—Improvements in valves and hydrants.

6890. J. Hendry, A. Hendry, and M. A. Hendry, Glasgow. March 31st.—Improvements in and relating to driving bands.

6899. B. R. Rowland and J. E. Slack, Manchester. March 31st.—Improvements in water-tube steam generators.

6902. J. Hamilton, Glasgow. March 31st.—An improved arrangement of turbine machinery applicable for the propulsion of ships.

6905. R. Holmes, Stockton-on-Tees. March 31st.—An improved equilibrium piston packing ring.

6919. E. W. Lewis, Coventry. March 31st.—Improvements in carburetters, particularly for fluid pressure engines.

6935. A. G Brewer and W. H. Brunt, Liverpool. March 31st,—Improvements in wrenches or turning tools.

7314. J. Niclausse and A. Niclausse. London. April 6th.—Improvements in cleaning boilers.

7316. E. Cack, London. April 6th.—Improvements in apparatus for regulating and reducing fluid pressure. (Date applied for April 8th, 1904.)

7318. L. J. Slee, Liverpool. April 6th.—Improvements in rotary engines.

7322. H. Wernitsch, Liverpool. April 6th.—Improvements in means for letting off air and water in heating apparatus and the like. (Date applied for April 6th, 1904.)

7325. E. A. Young, Erdington. April 7th.—Improvements in fire bars for steam boiler and other furnaces.

7346. N. Dakin, Leeds. April 7th.—Improvements in or connected with steam pistons and their rings.

7349. A. Stewart, London. April 7th.—Improved feed-water heater for locomotive and like boilers.

7361. J. B. Gott, and the Sandycroft Foundry Co., Ltd., Liverpool. April 7th.—Improvements in or connected with spring valves.

7375. The Westlake Motor Syndicate Ltd., and A. J. Westlake, London. April 7th.—An improved combined flywheel and belt pulley for explosion engines.

7396 L. W. J. Marsden, and The United States Metallic Packing Co., Ltd., London. April 7th.—Improvements in packing for pistons.

7398 E. D. Chester, London. April 7th.—Improvements in pan and roller mills.

7408. W. R. Kennedy, London. April 7th.—Improvements in or relating to devices for governing the speed of turbine or other waterwheels.

7413. J. V. Poplawski, London. April 7th.—Improvements in vapour generators. (Date applied for April 21st, 1904.)

7423. The Warwick Machinery Co., Ltd., and H. Burkinshaw, London. April 7th.—Improvements in shaft packing for steam turbines and the like.

7454. W. H. Hatfield, and J. N. Kilby, London. April 8th.—Improvements in or relating to locomotives.

7474. A. Mallock, London. April 8th.—A method of preventing the vibrations set up by unbalance steam engines or the like.

7477. T. Hubscher, London. April 8th.—A combined carburretter and inlet valve for internal combustion engines.

7509. W. Cross, London. April 8th.—Improvements in boiler patch plates. (Date applied for September 6th, 1904.)

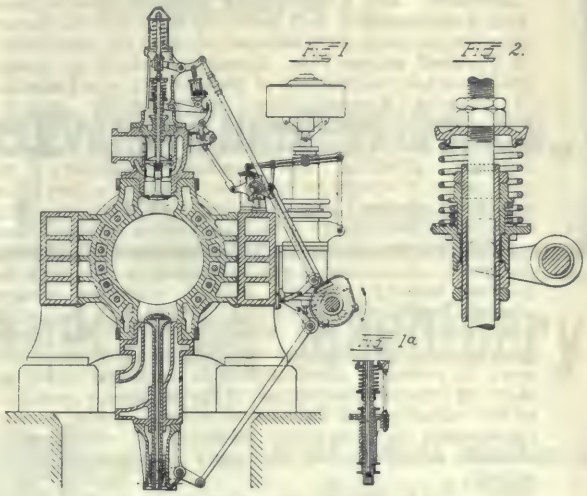
RECENT SPECIFICATIONS.

FOUR STROKE CYCLE GAS ENGINES.

A. J. Dudgeon, London. Accepted, March 16th, 1905.—The present invention has been devised with the object of attaining variable admission together with constant compression, that is to say, by first introducing air alone from the commencement of the suction stroke up to any desired point thereof, and then admitting explosive mixture of constant composition from this point up to the end of the stroke. In this way the best mixture is maintained around the igniters at the back of the cylinder and efficient ignition is assured even with the weakest charges.

The nature of the invention will be understood from the following description of one form of engine embodying the same :—

The valve which admits the explosive mixture to the cylinder, is carried by a stem adapted to be reciprocated vertically to open and close the valve. At a suitable point above this valve a slotted ring is secured to its stem so as to reciprocate therewith, in such a manner as to open and close an air supply conduit which delivers into the space behind the valve and thence into the cylinder when the ports in the ring come opposite the air conduit in the descent of the main valve. The stem of the main valve is actuated by a cam on a secondary



or lay shaft running at half the speed of the engine, through the medium of a roller working on said cam, which imparts motion to a rod, this latter being connected to the outer arm of a lever pivoted to a fixed point, the inner end of which lever is connected by suitable means to the stem of the main valve.

At a convenient point above the air supply conduit is a gas inlet adapted to be opened and closed by a valve disposed on the main valve stem concentrically with the main valve. The parts are so arranged that when the main valve and gas valve are on their seats, the nose of a catch lever is engaged by the catch, which is actuated by an eccentric on the secondary shaft through the medium of an eccentric rod connected to one arm of a rocking lever, the other arm of which is jointed to a rod connected to a lever on the shaft of a small cam on which works a roller on the tail of the catch. As the eccentric on the secondary shaft turns, the rocking lever is oscillated, and this oscillating motion is transmitted to the small cam so that the catch is caused to engage and disengage the nose of the catch lever.

NEW PUBLICATIONS.

"CALCAREOUS CEMENTS:"

Their Nature, Manufacture, and Uses; with Some Observations upon Cement Testing. By Gilbert R. Redgrave and Charles Spackman. Second revised edition. Charles Griffin and Co. 15s. net.

Many important developments have been made in the cement industry since the first edition of this work was published, consequently a considerable portion of this edition has had to be entirely re-written. As the writers point out, nearly all the plant which was regarded as essential ten years ago has now become obsolete, and the processes of manufacture have undergone a complete revolution. The authors' aim has been to give a technical description of the altered methods which now prevail in the production of Portland cement, and they have endeavoured to set before the reader an accurate account of the most recent processes adopted in this country, as also in the United States and on the Continent, where cement manufacture has developed to a remarkable extent.

The authors are of opinion that we are still far from realising what can be accomplished from the scientific utilisation of cement; they rightly claim that we are merely on the threshold of the great increase in the demand for this material which will take place when the engineer has fully grasped the extensive possibilities of "armoured" and "re-enforced" concrete constructions. After a retrospective and historical review of the cement industry, the work deals successively with the composition of Portland cement; the chemical analysis of cement raw materials, calculations of proportions, rapid methods of making determinations, and specific gravity; preparation of mixture of raw materials by the wet method; the dry process, treatment of raw materials, crushing, grinding, and auxiliary machinery; the calcination of cement mixture; revolving or rotary kilns; grinding, storing, and packing the cement; dust-collecting contrivances; the composition of mortar and concrete; cement testing; acceleration of tests for constancy of volume; the employment of slags for cement making; Scott's cement, selenitic cement, cements produced from sewage sludge and the refuse from alkali works, and Sidero cement; the plaster cements, and specifications for Portland cements. The work is profusely illustrated with sectional drawings showing constructional details of the machinery employed in this industry, and the volume is one we can heartily recommend to everybody desirous of obtaining an intimate knowledge of the many complexities of this industry.

"SCIENCE AND HYPOTHESIS."

By H. Poincaire, with a Preface by J. Larmor, D.Sc. The Walter Scott Publishing Company. 3s. 6d.

There has been of late, says Dr. Larmor in his scholarly introduction to this interesting work, a growing trend of opinion, prompted in part by general philosophical views, in the direction that the theoretical constructions of physical science are largely factitious; that instead of presenting a valid image of the relation of things on which further progress can be based, they are still little better than a mirage. The best method of abating this scepticism is to become acquainted with the real scope and modes of application of conceptions which, in the popular language of superficial exposition, often look bizarre enough. But much advantage will accrue if men of science become their own epistemologists, and show the world, by critical exposition in non-technical terms, of the results and methods of their constructive work, that more than mere instinct is involved in it. It would be hard, he continues, to find anyone better qualified for this than H. Poincare, whom he describes as "a stern, logical analyst, quizzing the cultivator of physical ideas as to what he is driving at and whither he expects to go."

The work is divided into four sections. Part I., "Number and Magnitude," descants on the nature of mathematical reasoning and mathematical magnitude and experiment. Part II., "Space," deals with non-Euclidean geometries, space and geometry, and experiments and geometry. In the third section, under the heading "Force," attention is given to classical mechanics, relative and absolute motion, energy and thermo-dynamics. The last part, which our readers will probably find the most interesting, discusses hypotheses in physics, theories of modern physics, the calculus of probabilities, optics, electricity and electro-dynamics.

NEW CATALOGUES.

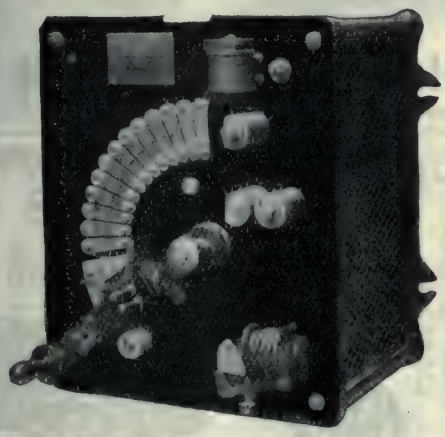
Messrs. Matthew Wells and Co., of Hardman Street Oil Works, Manchester, have been devoting special attention to a field for lubricating oils which has lately been very much to the fore, viz., motor lubrication. They point out in a pamphlet just issued by them that oil to be used in the cylinder of a motor engine should not only have a flash point much above that of the working temperature of the cylinder, but at that temperature it should retain sufficient body to ensure the presence of an effective film of oil between the walls of the cylinder and piston. The most essential properties required in the production of lubricating oils for the cylinders of internal combustion engines, are stated by Messrs. Matthew Wells and Co. as follows: (1) The oil must not be liable to decompose and produce pitch at working temperatures, and must be free from grit, acid, etc. This is where the fault lies in so many so-called cheap motor oils. (2) That it must have a high firing point and endurance at high temperature. (3) That the body at working temperature ought to be equal to that of a good steam cylinder oil at similar temperatures. (4) Limpid in winter as well as summer, to allow of its easy introduction into the cylinder or crank chamber by ordinary appliances. To fulfil these requirements to the greatest degree, they have introduced the following special oils: "Wellsaline" (regd.) Motor Oil "A," for all air-cooled motors and for small high-speed water cooled motors. "Wellsaline" (regd.) Motor Oil "W," for water-cooled motors, except those running at very high speed and inclined to overheat when they recommend "A"; this oil "W" is suitable also for bearings of all cars. "Wellsaline" (regd.) Motor oil "S," for steam motors, lorries, etc., working with high-pressure steam. "Wellsaline" (regd.) Motor Oil "S.H," for steam cars, etc., working with superheated steam. Fire test 800°.

The Lahmeyer Electrical Company, Ltd., New Oxford Street, W.C. Price list No. 25 describes and illustrates the firm's high-tension oil fuse. This consists of a cylindrical glass tube fitted with two end covers and the connecting parts. The top cover is provided with holes for filling the tube with oil and allowing of an equalisation of the pressure. On the inner part of the top cover is fitted an insulated metallic fusing chamber with a hole for the fuse wire. About half an inch of the bottom chamber is immersed in oil. To the fuse wire is fitted a copper connecting piece in contact with the bottom cover of the fuse. A spiral spring is also fitted to the bottom cover which keeps the fuse wire under tension. When the fuse blows, the connecting piece is thrown towards the fuse bottom with great force, the explosive gases are forced into the oil so that their temperature is instantly cooled down. The interruption of the current is thus instantaneously effected. A standard size is supplied up to 12,000 volts, 120 amps.

PAGE'S WEEKLY — Miscellaneous

"IGRANIC"

PATENTED



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Locomotives, &c.

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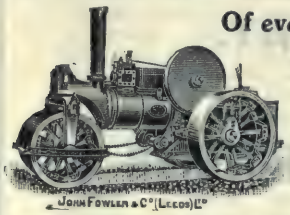

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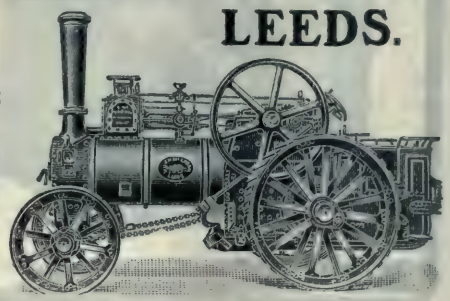

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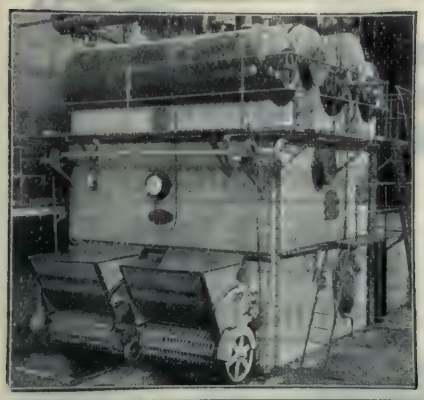
PAGE'S WEEKLY

Boilers, &c.



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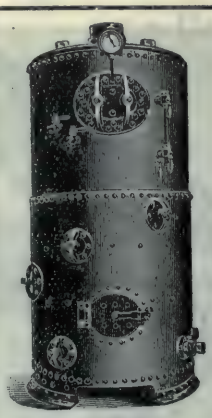

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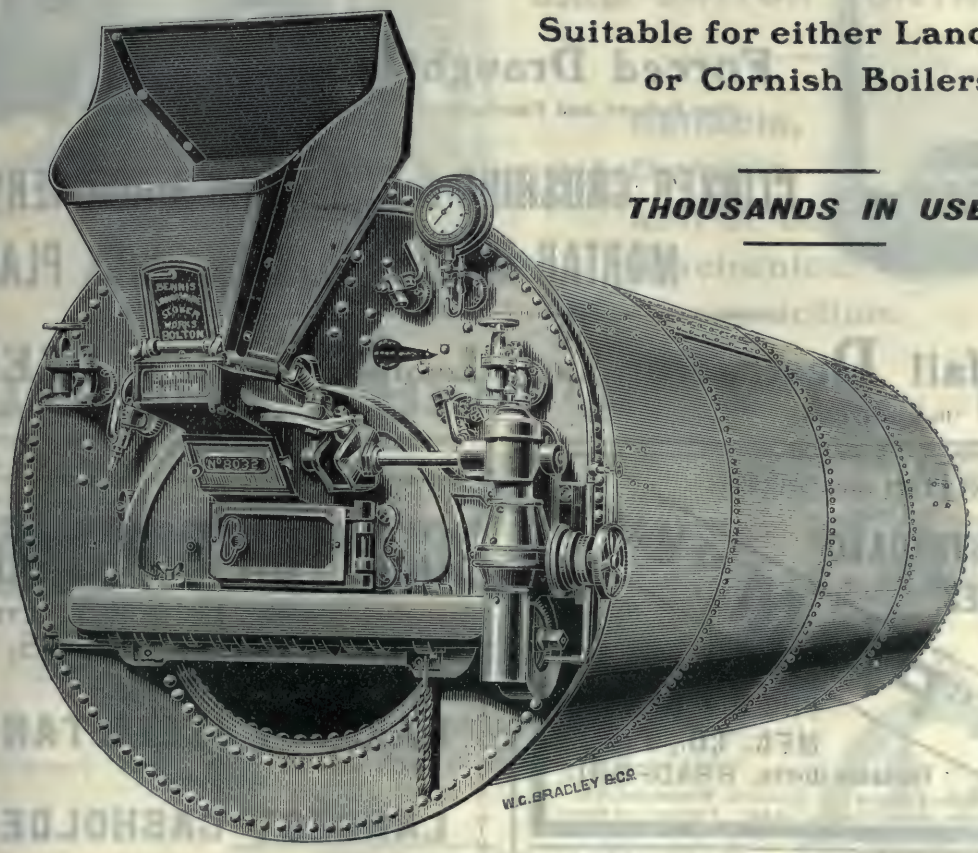

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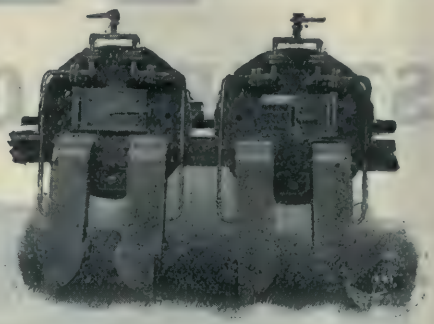
NO NUISANCE.

CHEAP STEAM.



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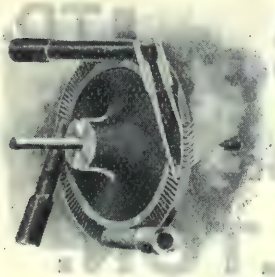

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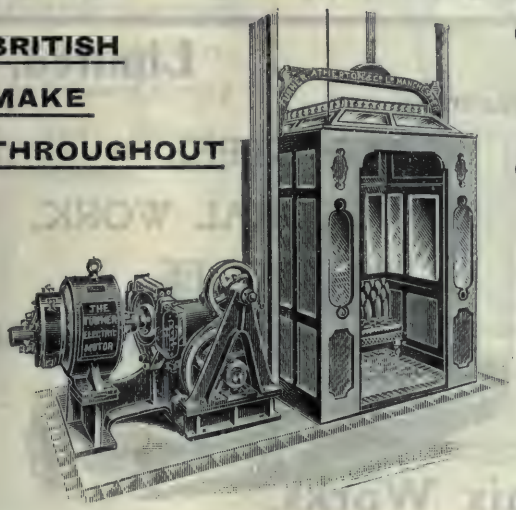

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Greater Volumetric Capacity and Higher Mechanical Efficiency than any other Fan designed for similar work.

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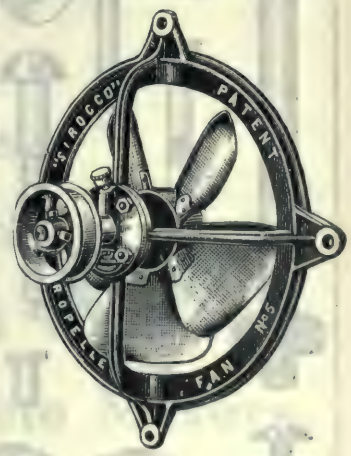

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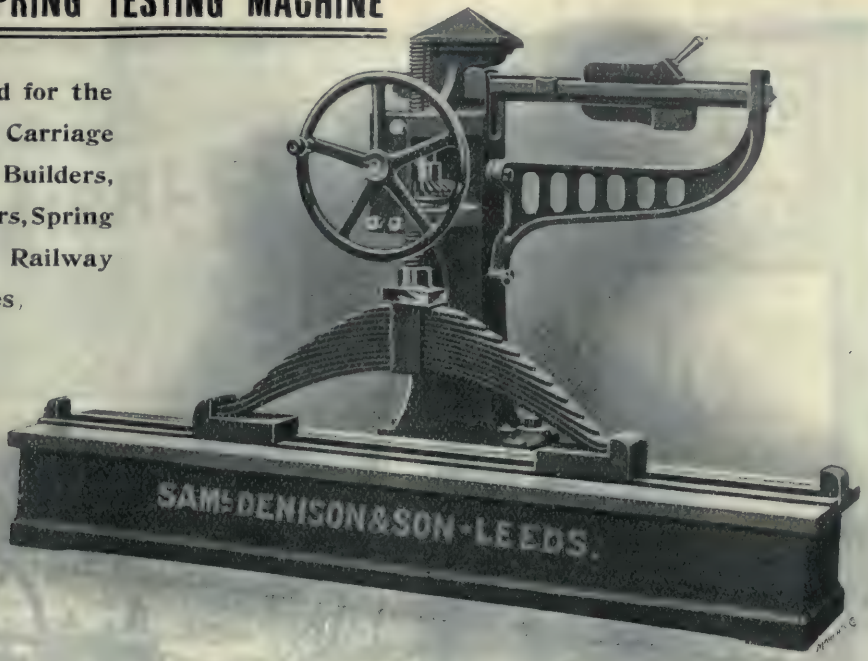
Specially adapted for the use of Railway Carriage Builders, Wagon Builders, Motor Car Builders, Spring Makers, and Railway Companies.



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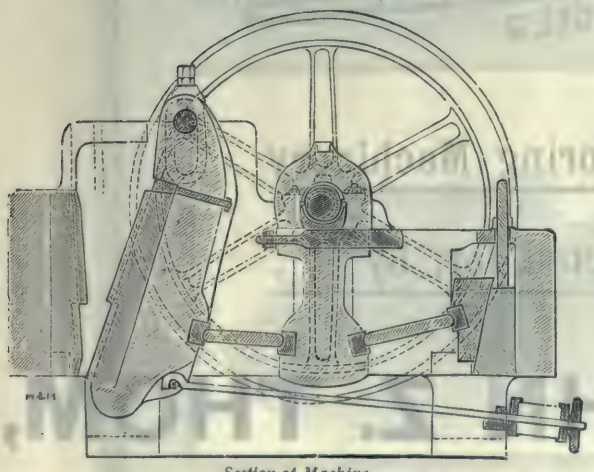

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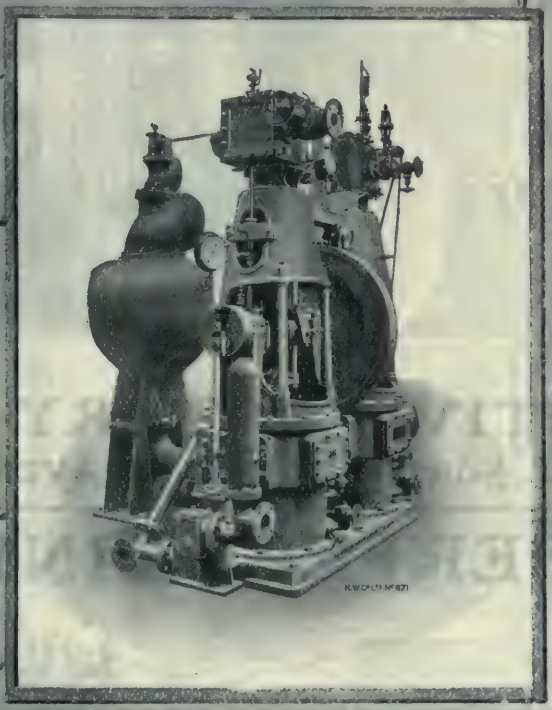

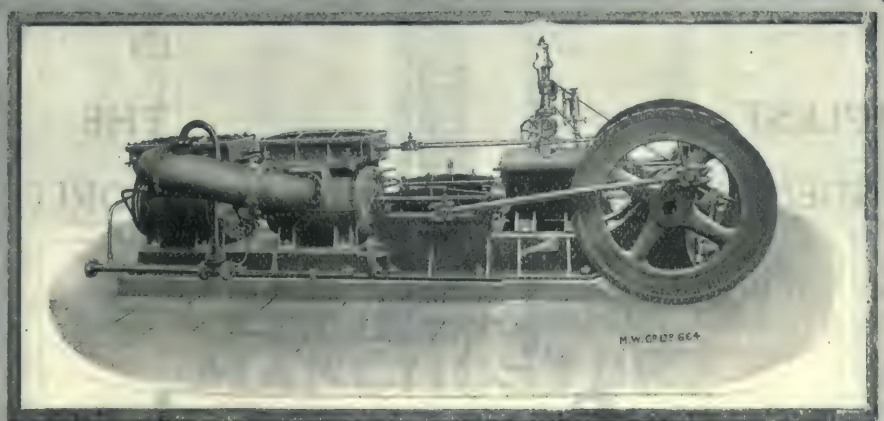

PAGE'S WEEKLY — Pumps, Tanks, &c.

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Automatic
Numbering
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STEEL WHEELS

Inexpensive
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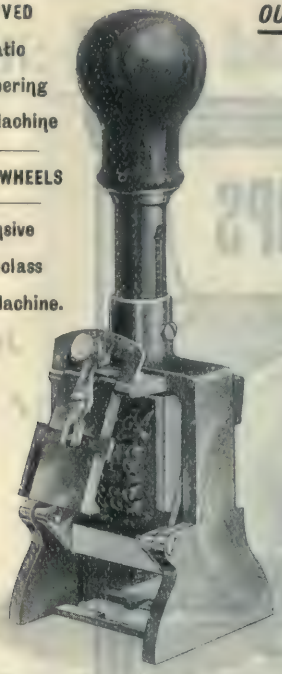

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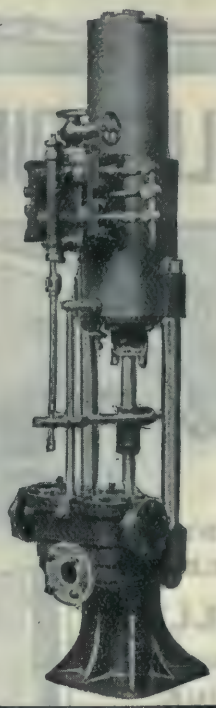

We make a SPECIAL Compound Direct Acting Slow Running

Boiler Feed Pump

ECONOMICAL AND EFFICIENT.

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AN IDEAL PUMP FOR GENERAL BOILER FEEDING PURPOSES.

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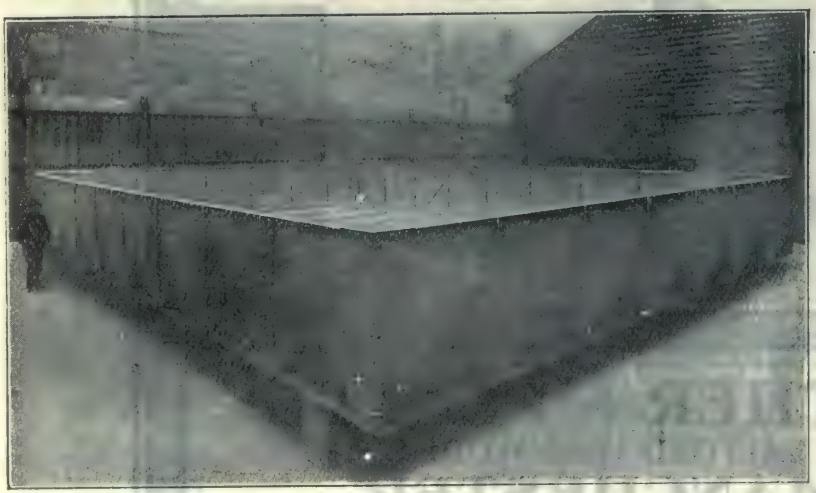

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Dealing with Correspondence.

FIRST: Copy your letters, agreements, and other outgoing correspondence on the **Shannon Letter Copier**, which copies ten times as quickly as an ordinary screw press.

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THE RESULT:

Perfect Copies. Instant reference to outgoing and incoming correspondence. Great saving of time, worry, and hard cash.

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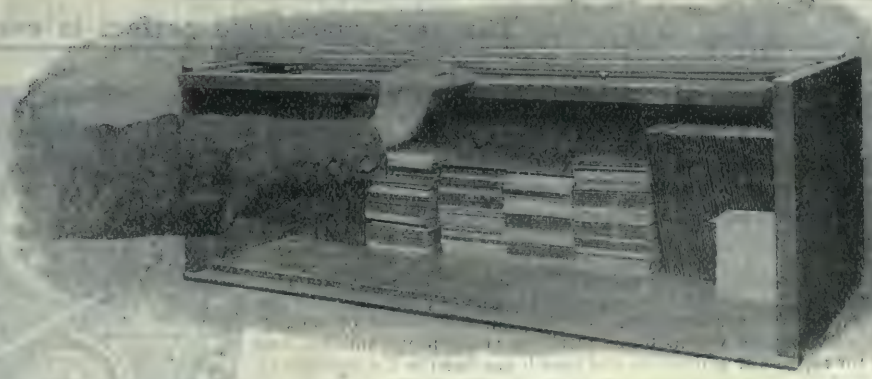

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PAGE'S WEEKLY — Time Recorders

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Can save at least 5% ON THEIR WAGES BILL, and thousands of employers do so by the use of the

"Dey" Time Registers

which are automatic machines for registering the hour and minute at which Employees start and finish work,

and, with the New Attachment provides, in addition to the weekly time and wages sheets, the CARD SYSTEM for COST KEEPING.

The "DEY" combines on **THE ONE MACHINE** the good points of all other Automatic Time Recorders on the market.

They are of British Manufacture Throughout.

They are absolutely the best Time Recorders in the World.

They are the cheapest up-to-date machine on the market.

They are guaranteed perfect in every detail.

THEY COMPEL PUNCTUALITY.

The "Dey" time and wages sheets combined do away with time books, wages books, and save 90% of clerical work. They are adaptable to every requirement, no matter how complicated.

A firm using 15 machines writes: "We shall be sorry when we change the boiler-shop machine, as it was one of the earliest, and has had the roughest of usage together with the maximum of vibration, and rudest of shocks; but it has gone on working the whole time (nearly six years) night and day, and when it goes to you for repairs, it will be the first time it has been in the infirmary."

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MORETON'S E.G. PAINT.

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Unequalled for . .

Coating all kinds of Machinery.

Ask for, and see you get the only genuine. Guaranteed to withstand heat up to 400 degrees Fahr., and is not affected by climatic conditions.

Trade Mark — H. Moreton

THE PAINT THAT WON'T COME OFF.

Send for Sample of the Sole Manufacturers—

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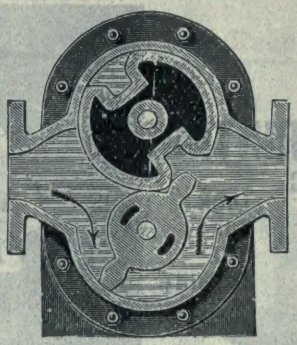

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POSITIVE ACTION.
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HIGH EFFICIENCY.

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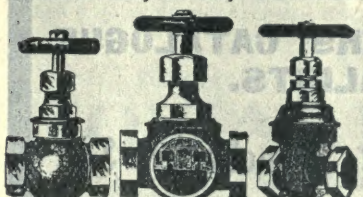
BRITISH STEAM SPECIALTIES, LTD.,

LEICESTER, & 80, TURNMILL ST., LONDON, E.C.



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VALVES ALL TYPES.

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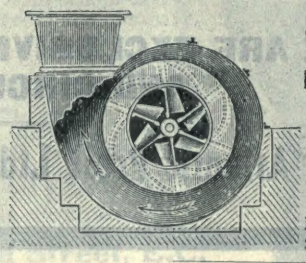

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